



Isle of Man Ship Registry

Casualty Investigation
Report No. CA121

**Isle of Man Registered “Sally Ann C”
Enclosed Space Fatalities and Near Fatality**

13th March 2015

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Foreword

The fundamental purpose of investigating a casualty, an accident or an incident under the Regulations¹ is to determine its circumstances and the cause with the aim of improving the safety of life at sea and the avoidance of accidents in the future.

It is not the purpose to apportion liability, nor, except so far as is necessary to achieve the fundamental purpose, to apportion blame.

Under Section 4 of the Isle of Man Merchant Shipping Act 1985 a person is required to answer an Inspector's questions truthfully. If the contents of this report were subsequently submitted as evidence in court proceedings then this would contradict the principle that a person cannot be required to give evidence against themselves. Therefore the Isle of Man Ship Registry makes this report available to interested parties on the strict understanding that it will not be used in any court proceedings anywhere in the world.

Acknowledgements

The author would like to acknowledge the following for their valuable assistance during this investigation;

- Carisbrooke Shipping Limited – Isle of Wight
- Master, officers and crew of the Sally Ann C

Many of the casualties that have occurred in enclosed spaces on ships have resulted from people entering an enclosed space without proper supervision or adherence to agreed procedures. In almost every case, the casualty would have been avoided if the simple guidance in this Chapter had been followed.

The rapid rescue of personnel who have collapsed in an enclosed space presents particular risk. It is a human reaction to go to the aid of a colleague in difficulty, but far too many additional and unnecessary casualties have occurred from impulsive and ill-prepared rescue attempts.

ISGOTT Edition V Chapter 10

¹ Merchant Shipping (Accident Reporting and Investigation) Regulations SD815/01

Abbreviations Used In This Report

2/O	Second Officer
No.3	Refers to No.3 Cargo Hold & Access
AB	Able Bodied Seaman
ALRS	Admiralty List of Radio Signals
BA or SCBA	Breathing Apparatus
°C	Degrees Celsius
C/E	Chief Engineer
CG	Coastguard
C/O	Chief Officer
CO₂	Carbon Dioxide
COSWP	Code of Safe Working Practices for Merchant Seamen (Consolidated Edition, 2011) by the United Kingdom Maritime and Coastguard Agency published by The Stationery Office.
CPR	Cardiopulmonary Resuscitation
cu.m	Cubic metre capacity
DPA	Designated Person Ashore (ISM Code Part 4)
DSC	Digital selective calling
GT	Gross tonnage
EEBD	Emergency escape breathing device
ISM	International Safety Management
ISGOTT	International Safety Guide for Oil Tankers and Terminals (Fifth Edition) Published by the International Chamber of Shipping, Oil Companies International Marine Forum and International Association of Ports and Harbours.
IMO	International Maritime Organisation
Kts	Knots measured in Nautical Miles per hour
LMT	Local mean time
MF	Medium frequency
m, m³, cm	Metres, cubic metres, centimetres
MSDS	Material safety data sheet
nm	Nautical miles (1nm = 1852 metres)
O₂	Oxygen
OS	Ordinary seaman
OOW	Officer of the watch
PPM	Parts per million
MRCC	Maritime Rescue Coordination Centre
RAF	Risk Assessment Form
RPM	Revolutions per minute
SD	Statutory Document
SMS	Safety Management System
SMR	Safety Management Review
SOLAS	IMO Convention for Safety Of Life At Sea
STCW	IMO Convention for Standards of Training, Certification and Watchkeeping
t	Tonnes (where 1t = 1000kg)
UTC	Universal Co-ordinated Time
VHF	Very High Frequency

Summary



Sally Ann C – No.2 / 3 Cargo Hold Recess & Entrance to No.3 Cargo Hold Access Hatch

On Friday the 13th March 2015 while on passage from San Pedro, Ivory Coast to Dakar, Senegal with a cargo of sawn timber, the Sally Ann C was involved in a very serious casualty. The result was the death of two senior officers from asphyxiation, the Chief Officer and the Chief Engineer. Furthermore the ship's 2nd Officer suffered serious injuries to his skull and was very nearly overcome by asphyxiation.

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The incident initially involving the Chief Officer began when he did not appear at his muster station for the weekly Friday afternoon emergency drill at 1615 hours. It was reported the Chief Officer was last seen walking forward up the port side of the ship's main deck at 1530. The ship's crew were assembled at their muster station in preparation for a drill at 1620. It was at this point the Chief Officer was discovered to be missing. The Master now ordered the immediate search of the vessel to find the Chief Officer.

At 1645 during the search two junior ratings discovered the access to Cargo Hold No.3 open and looking inside noticed the Chief Officer lying at the base of the stairway on platform No.2. One of the two deck rating's had a VHF walkie-talkie and notified the Master. On hearing the radio broadcast to the Master, other crew arrived at the scene in the cargo hatch recess area between No. 2 and 3 cargo hatches.

For unknown reasons the Chief Engineer then entered the enclosed space without wearing any protection against the atmosphere inside the cargo hold access. He subsequently collapsed and ended up lying on top of the Chief Officer on platform No.2. On hearing the cries for help from the Chief Engineer, the 2nd Officer then also entered the enclosed space without wearing any protection. He was overcome by the atmosphere inside the cargo hold access and collapsed. He ended up lying on top of the Chief Engineer close to platform No.2.

The remaining crew were now presented with two senior officers and one junior officer in the cargo hold access and mounted a rescue operation to retrieve the officers from the cargo hold access. The Master took command and control of the incident from the bridge, as he had no other navigating officers to keep watch. He remained in close contact by VHF radio with the deck cadet at the incident scene.

Four crew members wearing breathing apparatus entered the space to retrieve the three officers bringing with them equipment to assist the injured officers with their breathing. The 2nd Officer was the first to be lifted out of the cargo hold at 1715 and he was administered first aid at the scene. He had blood on the right side of his head. He remained unconscious but started to breathe after a few minutes. He was given oxygen by the crew and placed in the recovery position. Meanwhile the Chief Engineer was lifted out at 1720 and given CPR but there was no response. The crew continued to provide first aid and CPR to him for several hours. The Chief Officer was the last to be brought up from platform No.2 and out of the cargo hold at 1725, he was given first aid at the scene and CPR for several hours.

The Master did leave the bridge for a few minutes and came down to the incident scene in order to see if there was anything else that could be done or be provided for the injured crew. The 2nd Officer was moved to the port side of the main deck away from the recess area and into clearer fresh air to aid his recovery.

As darkness fell all the three officers were removed from the incident scene to a safe area on the Poop Deck. The crew continued their efforts with CPR to aid the recovery of the Chief Officer and Chief Engineer. Meanwhile as the 2nd Officer appeared to be breathing more regularly and although he remained unconscious, he was eventually moved to his cabin.

The Master contacted the Company DPA at 1745 by telephone and the Company emergency plan was put into action. The Master tried to call for assistance using a Pan Pan, urgency signal on VHF DSC and MF DSC, to other ships in the area and to shore coastal authorities in Guinea Bissau without success. He also contacted MRCC Dakar, but they were unable to assist until the Sally Ann C arrived within their coastal area. The Master also made contact with Rome Medical Centre station to seek medical advice. The Isle of Man Ship Registry was informed of the incident some time afterwards. At 2130 with the two senior officers showing no response to CPR, and neither showing no pulse and no breathing, the Master ordered the crew to stop the CPR. Shortly afterwards the two officers were removed to the ship's refrigeration area. During the evening another vessel in the vicinity the "Esperan" and now confirmed to be the Esperanza Del Mar, a

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Spanish Hospital ship. The medical doctor on board was able to provide further medical advice to the Master about the condition of the 2nd Officer.

The Master was now left with no other navigating officers on board to assist him with watchkeeping. However, it was discovered at a later point during the incident there was another Company vessel some 30 nautical miles to the north and ahead of the Sally Ann C. It was arranged to transfer a navigating officer from her to the Sally Ann C the next morning. This was duly expedited at 0900 on Saturday morning 14th March.

The Sally Ann C arrived off Dakar at 1800 on Saturday 14th March and dropped anchor. Following attendance on board by a doctor, local immigration and police, the 2nd Officer was removed from the ship to a local hospital and placed in intensive care. The bodies of the Chief Officer and Chief Engineer were also taken ashore at this time. Unfortunately the deceased officers were returned to the vessel at 0010 on Sunday morning 15th March due to local regulations and protocols.

Early on Sunday 15th March the vessel was allowed into the port of Dakar and berthed at 0525 at a lay by berth. The bodies of the two officers were eventually removed and taken to a local morgue for post mortem examination.

Ship Particulars and Casualty Details – Sally Ann C



Ship Particulars

Flag – Isle of Man (British)

Port of Registry – Douglas

Ship Type – General Cargo Ship

Official No. – 745662

IMO No. – 9338151

Year of Build – 2006

Call Sign – MPXF5

Owner – Bridge Shipping Limited – Isle of Wight

Technical / ISM / MLC Managers – Carisbrooke Shipping Limited – Isle of Wight

Classification Society – Lloyds Register of Shipping

Main Engine – Man B&W – 5180kW

Length – 136.43m (Overall)

Length – 126.88m (Registered)

Beam – 21.20m (Moulded)

Depth – 11.30m (Moulded)

Summer Draught – 8.35m

Sailing Draught – Fwd 5.98m, Aft 6.91m (departure San Pedro, Ivory Coast -10th March 2015)

Gross Tonnage – 9177.00

Net Tonnage – 4751.00

Casualty Details

Date / Time – 13th March 2015 at 1645 Ship Time (UTC)

Classification – Very Serious Casualty

Location – at sea, Atlantic Ocean, off the West African coast of Guinea Bissau

Vessel status – underway and making way - approximately 11.0 knots

Injuries / Fatalities – 1 / 2

Vessel damage – none

Crew complement – 13 crew + 1 riding squad fitter

Cargo on board – Sawn Timber in bundles of approximately 5200cu.m

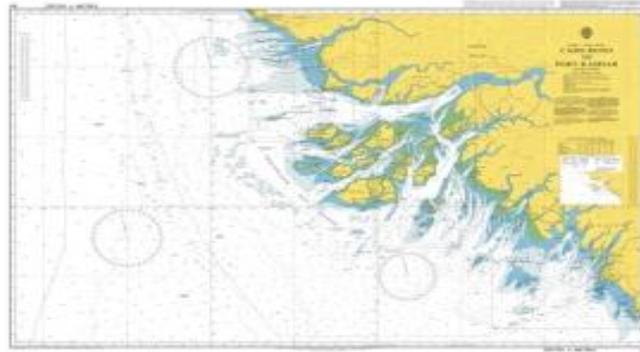
1. Narrative of Events

The following is a narrative of events based on the Sally Ann C crew actions. The narrative is based on interviews with those involved and evidence collected on board the Sally Ann C. All recorded times on the Sally Ann C, are ship's local time which was on UTC.

1.1 Location of Casualty



**Section of Admiralty Chart – BA 611→
Atlantic Ocean – Africa West Coast – Cabo Roxo to Port Kamsar**



**Admiralty Chart – BA 611→
Atlantic Ocean – Africa West Coast – Cabo Roxo to Port Kamsar**

Reproduced by United Kingdom Hydrographic Office

Environmental Factors - Weather: No precipitation
 Temperature: 29°C
 Barometer: 1009
 Wind: SE Beaufort force 2 veering W force 2
 Visibility: Good

1.2

**Sequence of Events
All times are ship time (UTC)**



Entrance to Cargo Hold No.3 at the cargo recess area, located midships between No.2 and No. 3 cargo hatches (frames 95 to 101)

13th March 2015

0745 to 1200 The Master kept the 0800 to 1200 watch and during the change of watch between the Master and Chief Officer at 0800 both officers discussed the ship's routine works for that day. It was decided to carry out an emergency drill about 1615 that afternoon. The fire drill was planned to take place at the port side bunker station. The Master recalls the Chief Officer appeared to be fine, healthy and in good spirits.

After breakfast on the morning of 13th March the crew met as usual about 0750 in the crew changing room where the Bosun explained to the assembled deck crew the sequence of jobs set by the Chief Officer. The O/S (crew No.9) set off to take the daily tank soundings which included soundings of the cargo hold bilges. At 0945 he joined the Bosun and Deck Boy (crew No.11) who were working on the MOB rescue boat davit. This was shortly before the crew took their morning break. Following the morning break he continued recording the tank soundings. On finishing this task at 1130 the O/S (No.9) telephoned the Chief Officer from the ship's cargo office, the officer was at that time in his cabin. He was told to leave the soundings in the cargo office as the Chief Officer normally filled in the tank sounding book. The O/S had noticed that No.3 cargo hold bilge sounding recorded a high reading, 2.54 metres.

The O/S returned to the Bosun and Deck Boy working at the MOB rescue boat. At 1145 the Chief Officer arrived at the MOB rescue boat to talk with the crew. The O/S overheard the conversation between the Chief Officer and Bosun. The Chief Officer explained to the Bosun; "that we will have to make soundings again, because No.3 bilge is already pumped out from engine room". Following the conversation the crew all went off to their lunch break between 1200 to 1300

1250 to 1600 At 1250 the Bosun met with the O/S (No.9) in the crew changing room and told him to re-sound all cargo hold bilges again. When he had finished recording the soundings he again left the figures in the ship's cargo office for the Chief Officer. The O/S noticed the new sounding for No.3 cargo hold bilge was now reading 1.22 metres. He did not see the Chief Officer nor did he communicate with him at this time. The O/S returned to his work with the Bosun and Deck Boy at the MOB rescue boat davit. All three crew took an afternoon break at 1500.

They returned to their work on MOB rescue boat davit at 1530. Shortly after returning to this work the Deck Boy noticed the Chief Officer walking up the port side of the main deck. He noticed him turn right into the cargo recess between No.2 and No.3 hatches. He thought the Chief Officer must be going to the Middle Store. The Deck Boy resumed his work. At 1550 the crew attending to the maintenance of the MOB rescue boat davit started to clean up and prepare for the drill at 1615.

About 1555 the 1200 / 1600 O/S deck watchman (crew No.8) left the bridge deck area where he had been painting to join the crew at the MOB rescue boat. Prior to his departure he did not see the Chief Officer in the wheelhouse with the 2nd Officer for the next change of watch at 1600. Similarly the Deck Cadet who had been resting all day joined the crew at the MOB rescue as they cleared up. The deck crew then made their way to the Poop Deck prior to the emergency drill at 1615.

1600 to 1700 The Chief Officer did not appear on the bridge to relieve the 2nd Officer and take up his OOW duties for the 1600 / 2000 watch. At 1615 the Master was in his cabin when he received a telephone call from the Chief Engineer asking about the planned drill, because; "all crew are now in standby position". The Master replied he was waiting for a call from the Chief Officer to say everything was ready. The Master now proceeded to the bridge and found the 2nd Officer on duty and not the Chief Officer. He asked the OOW the whereabouts of the Chief Officer. The 2nd Officer replied: "that maybe he will arrive soon as it may be some kind of delay from his side". The Master asked whether he had tried calling him in his cabin, he

replied yes he had, but the Chief Officer had not replied.

1600 to 1700 The Master left the bridge and ran down to check the Chief Officer's cabin; "he wasn't inside". The Master returned to the bridge and decided to sound the fire alarm. His decision to do so was based upon the idea the Chief Officer would hear the alarm and come to the muster station. It is estimated the alarm was sounded at 1624.

Cont'd

The muster assembly station is situated on the starboard side of the bridge deck. The Master requested the 2nd Officer to take command of the muster party and carry out a head count. The 2nd Officer left the wheelhouse and completed the head count at 1627 noting the Chief Officer was not present. He communicated this fact to the Master who immediately ordered a search of the vessel. The mustered crew now split up into four groups and began a search of the ship using the ship's standard stowaway search plan.

One group containing the O/S (crew No.8), the Deck Cadet and Deck Boy left the muster station and initially went inside the accommodation to collect a couple of VHF walkie talkie radios. They exited the accommodation onto the main deck via the Upper Deck access door on the port side into the athwartship hatch recess aft of cargo hatch No.4. They proceeded up the port side of the main deck, on reaching the cargo hatch recess between No.2 and No.3 hatches midships, the O/S (No.8) left the other two and went forward to the focsle area in search of the Chief Officer.

Another grouping of the Oiler and Engine Cadet searched outside via the Upper Deck area and the starboard side of the main deck as far as the aft crane access door which was found secured and closed. They then returned aft towards the accommodation.

A further group of the 3rd Engineer and Bosun searched the outside of the accommodation decks starting from the bridge and working their way downwards to the upper deck level.

The final and fourth group of the O/S (No.9) and the Cook went down to the boat deck and into the accommodation, and continued their search downwards through each deck inside the accommodation.



No.3 Cargo Hatch found in open position

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1600 to 1700 The Deck Cadet and Deck Boy left at the port side entrance to cargo hatch recess between No.2 & 3 hatches, watched the O/S (No.8) disappear forward. They turned to their right and entered the recess area and noted the access hatch to No.3 cargo hold was open. The cargo hatch is not visible from either the port or starboard main deck walkways.

Cont'd

The Deck Boy remembers the Chief Officer going forward earlier noting the Middle Store access was still closed and secure. Reaching the access hatch to No.3 they both looked inside and saw the Chief Officer lying face upward at the bottom of the stairway on platform No.2. He was not responsive to any calls from either of them. The Deck Boy stated he still thought at this stage that this was still part of the drill exercise that the crew were expected to rescue the Chief Officer.



**No.3 Cargo Hatch
View from top looking down onto platform 2 at base of stairway**

1600 to 1700 At 1645 the Deck Cadet who had a radio, called the Master and informed him they had found the Chief Officer inside the cargo hatch at No.3 access, but he was not responding to their calls.

Cont'd The O/S (No.8) who had gone forward to the focsle in search of the Chief Officer heard the radio conversation confirming the Deck Cadet and Deck Boy had found the Chief Officer inside the cargo hold access. He ran aft to join them at the incident scene and looked inside the cargo hold access noting the Chief Officer was lying apparently unconscious on platform No.2.

The 2nd Officer hearing the radio conversation between the Deck Cadet and the Master was still inside the accommodation area at this time. He then received a radio call from the Master to commence a rescue operation of the Chief Officer. He proceeded forward to the incident scene with the 3rd Engineer and Bosun following him out of the port side entrance to the poop deck accommodation.

In the meantime the Master receives a telephone call from the Chief Engineer enquiring about what is happening. He informs the Chief Engineer they have found the Chief Officer lying in the cargo hold access at No.3, but do not know what has happened to him.

Of the remaining crew, the Oiler, O/S (No.9) and the Engine Cadet heard the radio calls about the Chief Officer and proceed forward from the accommodation to the incident scene.

The Chief Engineer was spotted going forward on the main deck to the cargo recess area at 1650 by the Master who was standing on the port bridge wing. He tried to contact him by radio, without success. From the collated evidence the Chief Engineer arrives on scene after the other crew at about 1652.

As the Chief Engineer arrived at the scene the O/S (No.8) and Deck Boy are ordered by the 2nd Officer to bring the stretcher to the incident scene. Similarly the 3rd Engineer orders the Oiler and Engine Cadet to go and bring two SCBA sets and EEBDs forward. The Deck Cadet was ordered to go forward to the focsle and bring some rope to the incident scene.

Remaining at the incident scene were the 2nd Officer, Chief Engineer, 3rd Engineer, Bosun and OS (No.9). There was no rescue equipment on hand at this time. The OS (No.8) and the Deck Boy arrive back with stretcher just before 1700.

1700 to 1800 For an unknown reason the Chief Engineer spoke some expletive in Russian to the assembled crew in the recess area and then calmly walked over to the cargo access hatch and climbed in.

Very shortly afterwards the crew heard his cries for help inside the access. Immediately on hearing the cries the 2nd Officer without warning climbed into the cargo hold access after the Chief Engineer. His personal gas alarm sounded a warning "bleep". It was not determined in the investigation why he was wearing the personal oxygen meter, other than he had picked it up on coming forward to the incident scene. Although his alarm sounded, he was overcome by the atmosphere and ended up falling, taking a blow to his head and coming to rest on top of the Chief Engineer and Chief Officer at the bottom of the stairway at platform no.2.

As the Chief Engineer descended into the cargo hold the 3rd Engineer moved to the entrance of the recess on the port side of the main deck. The officer checked to see if any of the crew were returning to the incident scene with rescue equipment. Shortly afterwards the Bosun appears on the port side and tells him all three officers are inside the cargo hold. They run

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1700 to 1800 back into the recess and up to the cargo hold access. They confirm all three officers are inside the cargo hold and appear unconscious. The Oiler and Engine Cadet arrive back at the incident scene with the first two SCBA sets.

Cont'd The 3rd Engineer orders other crew to get another two SCBA sets from aft. The OS (No.8), Deck Boy and Engine Cadet go off aft again for the remaining SCBA sets. The 3rd Engineer informs the Master at 1703 by radio the Chief Engineer and 2nd Officer are now both lying in the cargo hold and are thought to be unconscious.

The Master orders the 3rd Engineer to prepare the SCBA sets, EEBDs and ship's oxygen sets for a rescue operation. He looks forward and notes some of the crew are already heading forward with rescue equipment and SCBA sets.

At 1709 the first four man team is ready to descend into the cargo hold and rescue the three officers. The Bosun entered the cargo hold space first followed by the 3rd Engineer, OS (No.8) and OS (No.9) to affect the rescue wearing breathing apparatus sets and carrying EEBDs. The Bosun reaches the 2nd Officer and tries an EEBD over his face for a couple of minutes. There is no response so it is decided to pull the 2nd Officer out immediately, they could not fit a harness around his body, so just attached a rope under his arms. Three of crew pulled on the rope from the top of the access point.

The 2nd Officer is pulled clear of cargo hold about 1715. He is placed on deck close to the Middle Store access where the Cook and Deck Boy start CPR and first aid. It takes several minutes before for the 2nd Officer responds to the CPR, he begins breathing very shallow at first and remains unconscious. The Cook and Deck boy roll him over into the recovery position and started to give him oxygen.

Meanwhile the 3rd Engineer comes out of the cargo hold and his place in the rescue team is taken by the Deck Cadet.

The Chief Engineer has an EEBD placed over his face but there is no response. The harness and rope is attached to him and he is pulled out of the cargo hold at 1720. His unconscious body is placed on the deck close to the Fan Room access hatch. The 3rd Engineer and Engine Cadet start CPR on the Chief Engineer.

Finally the Chief Officer's body is removed from the cargo hold at 1725 and he is placed on deck to the port side of the cargo hold access and given CPR by the Cook and OS (No.8).

The Master is informed that all three officers are out of the cargo hold. He is told the 2nd Officer is breathing and has a pulse, but remains unconscious. The Chief Engineer is showing no response to CPR, he is not breathing and has no pulse. Similarly the Chief Officer is in the same condition, not breathing, no pulse and is not responding to CPR. The crew continue to provide CPR.

The Master remained on the bridge throughout the rescue operation. When it was safe to do so he left the bridge and attended the incident scene to "see for his own eyes", the situation.

He returned to the bridge and at 1743 and made a satellite telephone call to the Company DPA informing him of the incident on board. This was followed by an e-mail to the Company at 1750.

1800 to 2400 At 1808 the Master placed a telephone call to the Rome Medical Centre requesting medical advice on the injured crew. This was followed by an e-mail to the Medical Centre at 1820. This was followed by a second e-mail to Rome at 1850.

1820 the Master issued a "Pan Pan", "Pan Pan" urgency call on both VHF DSC and MF DSC

to any ships in the area and the Guinea Bissau CG. He did not receive any immediate reply.

1800 to 2400 About 1850 the Master was contacted by another Company vessel “Vectis Falcon” which was apparently some 30nm to the north of the Sally Ann C. It was agreed to meet at first daylight the next morning and transfer the spare 2nd Officer on board to the Sally Ann C.

Cont’d

At 2010 due to the falling light it was decided to move the three officers to the poop deck area and continue treatment. The 2nd Officer remained the same, shallow breathing, weak pulse and unconscious, the other two officers were showing no response to CPR, not breathing and no pulse detected with either officer.

At 2014 the Master had a telephone conversation with MRCC Dakar, and asked for assistance for the 2nd Officer and whether it was possible for helicopter transportation. They requested the ship’s position and acknowledged it would be better to contact Guinea Bissau. The Master informed MRCC Dakar he had already tried contacting Guinea Bissau.

At 2030 the 2nd Officer was removed inside and placed in his cabin bed where two of the crew remained with him.

At 2058 the Master sent a message to MRCC Dakar with ship’s details and information about 2nd Officer.

At 2130 the Master decided that after four hours of fighting to save the lives of Chief Officer and Chief Engineer to stop all attempts at CPR and first aid treatment. At 2155 the bodies of the two officers were removed to the ship’s refrigeration area.

At 2230 the Master receives a telephone call from the “Esperanza Del Mar ” who had a medical doctor on board. Medical advice was passed to the Master on the treatment of the 2nd Officer and the Master confirmed the 2nd Officer’s condition.

As the sole navigating officer the Master remained on the bridge throughout the night until the next morning when the ship to ship transfer of a spare 2nd Officer from the “Vectis Falcon” was completed.

1.3 Injuries to Crewmembers

Chief Officer Overcome by lack of oxygen on entering No.3 cargo hold access resulting in his collapse. The results of the post mortem examination confirmed, acute cyanosis of the extremities, general congestion of the viscus, cerebral oedema. Death compatible to asphyxia by hypoxia and lack of oxygen.

Chief Engineer Overcome by lack of oxygen on entering No.3 cargo hold access resulting in his collapse. The results of the post mortem examination confirmed, cyanosis of the fingers, general congestion of the viscus, cerebral oedema. Death compatible to asphyxia by hypoxia and lack of oxygen.

2nd Officer Overcome by lack of oxygen on entering No.3 cargo hold access resulting in his collapse. Likelihood of a fall, which resulted in a blow to the right side of the head. Severe head injury and swelling of right side of skull.

Hospitalisation, at port of Dakar, Senegal on arrival. The patient is in recovery, however, there appears to be some cardiac damage, additionally suffering from headaches, confusion and lethargy with a blood gas carbon dioxide level over 45mm HG. A cardiac test with ECG shows a right branch block. The 2nd Officer is currently undergoing treatment with anticoagulant drugs.

2. Comment and Analysis

Foreword

This section aims to analyse the factors affecting the Master, officers and crew, the lack of preparation by the Chief Officer before entry into cargo hold No.3, the reasons why officers entered the space and the technical / ISM Manager's procedures governing access to enclosed spaces.

Throughout this section the abbreviation "SMS" is used to refer to the vessel's safety management system procedures on board.

2.1 The Deceased and Injured Crewman

Chief Officer (deceased):-

Ukrainian national of 43 years old. He had over 12 years of sea experience with Carisbrooke Shipping. In the previous 4 and half years he had served on seven Carisbrooke ships as Chief Officer.

The Chief Officer had a valid Ukrainian Certificate of Competency STCW II/2 as Chief Mate on ships of 500 gross tonnage or more, issued on the 18th July 2007 and valid until 31st December 2016. He was issued with an Isle of Man Endorsement attesting the recognition of his national certificate on 4th June 2012. All other statutory required certification including his medical certificate issued on 23rd January 2015 was inspected and found in order. This included a certificate of training for a Safety Officer issued on the 20th August 2012, following completion of the Company's computer based training course.

During interviews with the Sally Ann C crew the Chief Officer was found to be hard working and conscientious. He appeared to have a good working relationship with the other crew members.

Chief Engineer (deceased):-

Russian Federation national of 66 years old. The officer had been with Carisbrooke Shipping for the past seven years, and sailed as Chief Engineer for the past four years. He had actually been on his 2nd tour of duty aboard the Sally Ann C.

The Chief Engineer had a valid Russian Federation Certificate of Competency STCW III/2 as Chief Engineer valid on motor ships only, issued on the 9th April 2001 and his current endorsement was found valid until 30th September 2015. He was issued with an Isle of Man Endorsement attesting the recognition of his national certificate on 6th December 2010. All other statutory required certification including his medical certificate issued on 20th June 2014 was inspected and found in order.

During interviews with the Sally Ann C crew the Chief Engineer was found to have a good working relationship with other crew members.

2nd Officer (Injured): -

Philippines national of 38 years old. The officer had seven years of experience with Carisbrooke Shipping. He had over 4 years of experience as 2nd Officer, and had been aboard the Sally Ann C since early November 2014.

The 2nd Officer had a valid Philippines Certificate of Competency STCW II/1 as Officer in Charge of a Navigational Watch issued on 13th September 2006 and his current Philippines endorsement was valid until 8th August 2016. He was issued with an Isle of Man Endorsement

attesting the recognition of his certificate on 11th November 2014. All other statutory required certification including his medical certificate issued on 8th July 2014 was inspected and found in order.

On board familiarisation

All officers and crew members on board are trained in the requirements of STCW Tables A-VI/1-1 to 1-4. STCW Table A-VI/1-4 on the observation of safe working practices which includes, precautions to be taken prior to entering into enclosed spaces.

All Officers and crew had completed their shipboard familiarisation training when initially joining the ship which included, inter alia, procedures for enclosed space entry and rescue from an enclosed space, explain the H & S at Work policy, safe work permit arrangements and risk assessments.

Crewing & Hours of Rest

There was no evidence to suggest that the Chief Officer, Chief Engineer and 2nd Officer, or any other crew member was suffering from fatigue, as evidenced by a review of the ship's hours of rest and work records. Neither was either officer suffering from any ill effects from, alcohol, a known medical condition or from drugs.

The ship's minimum safe manning certificate was issued for a minimum of 10 persons, it was noted the actual crew on board numbered 13 persons as recorded by the ship's crew list.

Furthermore it was established through the processes of the casualty investigation including interviews and witness declaration statements that all crew members had a good standard of the English language.

Therefore none of the above was considered to be a contributory factor or cause in relation to this casualty incident

2.2 Cargo Carried

The Sally Ann C completed a two part load of sawn timber in bundles for discharge in Dakar, Senegal. The first port of loading was Douala, Cameroon, the second port was San Pedro, Ivory Coast.

The shipping agents in the port of San Pedro, Ivory Coast have informed the Company that according to the Shippers when delivered, the sawn timber bundles are compulsorily treated to minimise the risk of transmission of timber borne diseases. This may include heat treatment for the regulation of wood packaging material in the international trade.

General data for the carriage of wood products is re-produced below from the adopted amendments to the IMSBC Code introduced in IMO Resolution MSC.318(89) dated the 20th May 2011. This document was found on board at the time of the investigation and available for all officers to view.

Wood Products – General

Precautions:

1. Capable of causing in cargo spaces and adjacent spaces, oxygen depletion and increase of carbon dioxide. Hence personnel considering entry into these areas are only allowed after tests have been carried out and the oxygen level is shown at 21%. If not 21%, additional ventilation shall be carried out and re-measurement taken after a suitable interval has lapsed. Personnel to wear oxygen meter and activate same when entering an enclosed space.....

Hazard:

1. These cargoes are liable to cause oxygen depletion and increase carbon dioxide in the cargo space and adjacent spaces.

Definition of Carbon Dioxide:-

Colourless, odor-free, non-combustible gas. It is heavier than air, meaning it can displace atmospheric oxygen in poorly ventilated spaces and form CO2 reservoirs, hence risk of suffocation.

2.3 Is the Cargo Hold an “Enclosed Space”?

Under the Code of Safe Working Practices a dangerous space is defined in the regulations as;

“any enclosed or confined space in which it is foreseeable that the atmosphere may at some stage contain toxic or flammable gases or vapours, or be deficient in oxygen, to the extent that it may endanger the life or health of any person entering that space.”

Furthermore in the Company’s P & I Club issued document found on board – A Master’s Guide to Enclosed Space Entry, states;

“an ‘Enclosed Space’ is defined as a space that has the following characteristics:

- *Limited openings for entry and exit.*
- *Unfavourable natural ventilation.*
- *Not designed for continuous worker occupancy.*

Enclosed spaces include, but are not limited to, cargo spaces, double bottoms, fuel tanks, ballast tanks, pump rooms, cofferdams, void spaces, duct keels, inter-barrier spaces, engine crankcases, boilers, sewage tanks, and adjacent connected spaces”.

This list is not exhaustive and each vessel must produce its own list as to where all the enclosed spaces are identified

At the time of the investigation no evidence could be found that the ship possessed a record noting the whereabouts of all the enclosed spaces on board. The existing generic Risk Assessment Form in use on board the Sally Ann C, for entry to an enclosed space, form RAF No.8 does not indicate or include the number of enclosed spaces on the ship.

Extract from IMO Res. A1050(27): Revised Recommendations for Entering Enclosed Spaces aboard Ships;

“Assessment of Risk”

“The company should ensure that a risk assessment is conducted to identify all enclosed spaces on board the ship. This risk assessment should be periodically revisited to ensure its continued validity”

There was no evidence the SMS procedures contained specific shipboard operational procedures on the carriage of timber related products and the dangers of oxygen depletion. It does however, mention in section 6.4. Cargo Operations as to whether the relevant documents have been consulted, including in this case the IMSBC Code. There was, however, evidence the Master was aware of the Isle of Man Ship Registry, MSN No. 23, entry into enclosed spaces and the dangers posed by oxygen depletion from timber cargoes. Whether the Chief Officer, Chief Engineer and 2nd Officer were aware of the contents of MSN 023 and related hazards associated with this cargo could not be determined at the time of the shipboard investigation.

2.4 Safety Management System and Access to Enclosed Spaces

The vessel is required by Isle of Man statutory regulations (SD421/98) to comply with the International Safety Management (ISM) Code. The ISM Code states requirements for the Management of Safe Operation of Ships. The vessel has procedures on board known as the Safety Management System (SMS) in order to operate the vessel safely and respond to emergencies in compliance with statutory, industry and company requirements. The SMS is audited at frequent intervals by the Technical Managers, and Flag State authority.

- Last ISM External Audit by Flag:- 20/06/2014 Initial Audit –2 NCNs raised, none related to this incident (audit visits approx. every 2.5 years)
- Last ISM Internal Audit by Technical Managers:- 18/06/2014 three observations, none related to this incident (approx. every 12 months)
- Last Technical Inspection by Technical Managers:- 19/07/2014 – minor deficiencies, none related to this incident (approx. every 6 months) – *the next Superintendent’s visit to ship had been originally planned for the port of Dakar, as vessel had been continually trading in and out of inaccessible West African ports.*
- Last Port State Control Inspection:- 01/10/2014 – Itajai, Brazil 3 deficiencies raised, none related to this incident

Findings from recent audits and inspections indicate no issues regarding enclosed spaces and enclosed space entry procedures.

The Company does not provided specific procedures on access to or entry to enclosed spaces within the main body of their SMS. They have however, provided a fleet standing order, TSO 46 – Entry into enclosed spaces dated the 16th May 2013 (See Appendix 2). This standing order was instigated following a number of reported incidents on Company ships where required procedures for entry into enclosed spaces were not implemented and / or followed correctly by the ship’s crew.

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Extract from IMO Resolution A.1050 (27) on the Revised Recommendations for Entering Enclosed Spaces Aboard Ships;

3.2 The company should ensure that the procedures for entering enclosed spaces are included among the key shipboard operations concerning the safety of the personnel and the ship, in accordance with paragraph 7 of the International Safety Management (ISM) Code.

Similarly reference was made in the fleet standing order TSO 46 to two publications which were already part of the ship's library prior to these reported incidents. These publications are considered to be "third party" documentation to a ship's safety management system. These documents were the Code of Safe Working Practices for Merchant Seaman (COSWP Chapter 17) and the Master's Guide to Enclosed Space Entry issued by their respective P & I Club.

The Company also provided within the framework of the issued TSO 46 on 16th May 2013, a copy of the latest IMO publication, IMO Resolution A.1050 (27) on the Revised Recommendations for Entering Enclosed Spaces Aboard Ships.

Furthermore the Company provided with the issue of TSO 46 laminated posters on Enclosed Space Entry. During the casualty investigation it was verified there were six such laminated posters available in the accommodation providing applicable information on entry to an enclosed space.

However, further research into other Isle of Man flag state external audits carried out on Company managed vessels has provided some additional information. In this instance one vessel was issued with a MLC deficiency note on the 25th June 2014 in respect of MLC Title 4.3. and Regulation 4.3, with reference to DMLC Part 2 Section 11 in that;

The vessel demonstrated that it was maintaining records for enclosed entries. However, there was no objective evidence that the vessel was maintaining records of cargo space entries as required by IMO A(27) 1050. The Master and Chief Officer confirmed that permission was required to enter cargo holds however no records of the same were maintained of entry permits. It is recommended the ship establishes a system to record such permits in accordance IMO Res.A.1050(27), and the Merchant Shipping Reg 279/89 and MLC Reg 4.3.

The corrective action process concluded;

The Master shall carry out additional training with all crew members. It shall be pointed out that cargo holds are also enclosed spaces if closed, irrespective of cargo being carried inside or not. The following publications shall be discussed;

SMS manual sections 5.12 and 5.14; Fleet Standing Order TSO 46; COSWP Chapter 17; Risk Assessment RAF No.8; Ship's DVD title "Enclosed Space Entry – Hazard Awareness"

Additional comment; It seems the practice of enclosed space entry is well known BUT the definition of "enclosed space" needs to be highlighted



Copy of Enclosed Space Entry Poster found on board Sally Ann C

The Company do have an appropriate Safety Work Permit (SMS 5.12 see Appendix 4); Risk Assessments (SMS 5.14 See Appendix 3), and Rescue from enclosed spaces (SMS 11.4.21 See Appendix 5) procedures in place. However, only the latter document makes reference to any of the “third party” documents available on board.

2.5 Cargo Hold Bilge Soundings / Cargo Hold Accesses

As revealed during the investigation the daily tank soundings, and in particular the cargo hold bilge sounding at No.3 starboard cargo hold bilge was significant. A reading of 2.54m was obtained during the morning soundings. Readings taken of the tanks were on average 0.20m with one tank reading 0.57m.

This obviously raised some concern with the Chief Officer, who requested the Bosun to have the cargo hold bilges re-sounded in the afternoon. It has been verified by the 3rd Engineer that bilge pump for the cargo hold bilges was run late on the morning of the incident, prior to the lunch break. The afternoon reading obtain by the OS (No.9) for No.3 cargo hold bilge sounding was 1.22 m.

It can only be presumed the Chief Officer was worried that something was wrong on the basis of these bilge readings. Whether there was some form of ingress into the cargo hold sounding pipe as a result of the cargo hold temperature and high humidity, resulting in drainage of condensation to the cargo hold bilge. This was not determined at the time of the investigation on board.

However, following the eventual discharge of the sawn timber cargo at Dakar. The Master has reported there was no particular problem with the starboard hold bilge or sounding pipe at No.3 cargo hold. It can only be presumed the sounding pipe was either blocked, or that condensation inside sounding pipe due to the high humidity inside the hold was in some way providing a false reading.

The Chief Officer did not communicate his thoughts on this problem to the Master or any other officer. However it is presumed the Chief Engineer may have known something as he arranged for the cargo hold bilges to be pumped out. Neither possibility can be verified as they both died in the incident.

On the basis of the above theory it is thought the Chief Officer decided to investigate No.3 cargo hold starboard bilge using the access and stairway to No.3 cargo hold.

It has been determined the only cargo hold access opened since the vessel departed from San Pedro following the incident was in fact No.3 cargo hold access.

Each ship's access point is secured by its own securing "dogs". Additionally cargo hold accesses are secured by a further securing nut requiring a special key that is normally held in the ship's office. Each cargo hold access also has a plastic security tag with a unique numbering system. The sequence and numbering is recorded in a log book.

It was verified during the investigation that all plastic securing tags were in place and the recorded numbering system was correct. The only missing tag was that for No.3 cargo hold access. A subsequent search of the area around the cargo hold recess between No.2 and 3 hatches and Chief Officer's clothing has not revealed the whereabouts of this security tag.



An example of a secured cargo hold access

The ship's Master eventually gained access to No.3 cargo hold during the discharging of cargo and a broken security tag was found hidden amongst the dunnage lying on platform 1 at the base of the vertical ladder. It was subsequently identified as the missing security tag number 3008.



No.3 Cargo Hold Access showing Platform 1 at base of vertical ladder

2.6 Entry to No.3 Cargo Hold & Atmosphere

The last reported sighting of the Chief Officer was noted to be shortly after 1530 when some of the crew returned to their work at the MOB rescue boat davit. He was seen walking up the port side of the main deck and turning right into the cargo hold recess at No.2 / 3 hatches.

The Deck Boy who observed the Chief Officer, presumed he must have been heading for the Middle Store. He made no mention of reporting the sighting to any other at the time of the muster. The Chief Officer was discovered at 1645 inside the access to No.3 cargo hold.

It was confirmed the Middle Store had not been opened. No other cargo hold access or opening on the main deck had been opened. The only open access was to No.3 cargo hold as discovered by the two crew during the search for the C/O.

The interviews with the crew revealed the Chief Officer had not reported his intentions to any other crew member. It is possible the only other person who may have known anything was the Chief Engineer. Therefore it is presumed he was acting entirely alone in his actions to enter the cargo hold. The most plausible theory being the Chief Officer wanted to investigate the cargo hold bilge, presumably due to the higher than normal reading.

As part of the investigation a measure of the oxygen levels in No.3 cargo hold access and stairway were taken using another portable oxygen meter. The meter was lowered into the cargo hold access and within a couple of metres of its descent it went into alarm mode. The test was repeated several times and oxygen level readings noted. Note in the photograph below, one such reading indicated an oxygen level of 4.5%. The lowest observed reading was noted to be 3.5% of oxygen.



Oxygen content measured at No.3 Cargo Hold Access on 16th March 2015

Similarly test readings were then undertaken using the ship's Draeger equipment to measure for the presence oxygen and other gases in No.3 hold access. The manually operated pump unit was supplied with a 10 metre length of hose. The ship was found to be supplied with numerous boxes of glass detection tubes, covering measurements for inter alia, oxygen, carbon monoxide, carbon dioxide, methane, chlorine, nitrous fumes and hydrogen sulphide.

The results found the presence of carbon dioxide at approximately 7m below the access entrance. This is just underneath the second platform which is approximately 6.4m below the Upper Deck level. The depth of the hold access is measured at 9.991m.

Note the change in colour of the test tube crystals to a blue/violet colour and the extent of the graduated measurement indicated on the photograph at 6.0% by volume. This would indicate the lower part of the cargo hold access space to have a large concentration of carbon dioxide gas. The concentration of carbon dioxide gas at higher levels within the cargo hold access was not determined at this point in the investigation. A similar test for carbon monoxide resulted in a zero reading.



Draeger tube reading indicting presence of Carbon Dioxide

No.3 cargo hold was found secured in way of all ventilation dampers and therefore no ventilation had been introduced into space since the ship's departure from San Pedro on the evening of the 10th March. It was confirmed at the preserved incident sight that no ventilation dampers had been opened and that the cargo hold ventilation had not been used prior to the Chief Officer entering the cargo hold access space.

The cargo of sawn timber had three days in which to deplete the cargo hold oxygen levels following departure from San Pedro.

Due to the nature of the trade and the carriage of such cargoes as sawn timber, natural and / or mechanical ventilation is not considered. There are no specific or special requirements for the carriage of this type of cargo. The cargo is non-combustible and presents a low fire risk.

Later during the investigation the ship's cargo hold ventilation system was run and found to be adequate.

The contributable factors to the hazardous atmosphere present in the cargo hold would have been due to;

- the oxygen depletion;
- the presence of other gases in this case carbon dioxide,
- temperature extremes inside the cargo hold, the ship being in the Tropical zone
- the presence of dust from the sawn timber cargo, and
- the absence of free flowing air, in that the vessel's cargo hold ventilation dampers were closed and no mechanical ventilation was being run.

The health effects and consequences of lack of oxygen in an enclosed space are listed in the

table below. These effects are more than likely to happen without warning.

% oxygen content effect	
23.5%	Oxygen enriched atmosphere. Disorientation, breathing problems, vision
19.5%	Absolute minimum acceptable oxygen level
15 to 19%	Impaired coordination. Decreased ability to work strenuously
12 to 14%	Respiration increases. Poor judgement
10 to 12%	Respiration increases. Lips blue
8 to 10%	Mental failure. Fainting. Nausea, unconsciousness, vomiting
6 to 8%	8 min: fatal. 6 min: 50% fatal. 4–5 min: possible recovery
4 to 6%	Coma in 40 seconds. Death in 3 minutes

It can be identified from the table above the Chief Officer was very quickly overcome upon entering the hold access space. He was asphyxiated due to the low levels of oxygen and presence of carbon dioxide. The fact he was more than likely inside the cargo hold access space for approximately one hour prior to his discovery, draws the conclusion he was probably dead prior to being found by the crew.

Similarly the very low levels of oxygen found under testing just inside the entrance to the space confirm why the Chief Engineer and 2nd Officer were overcome. When the C/E entered the hold access space in his attempt to rescue the C/O, and subsequently the 2/O in his attempt to rescue the Chief Engineer.

2.7 Entry into Enclosed Spaces with Atmosphere known or suspected to be unsafe

Although the procedure for entry to an enclosed space is not clearly stated in the main body of the SMS. The subject is dealt with in the technical standing orders, numbered TSO 46. This publication makes references to the Company standing orders and procedures referenced for an entry to enclosed spaces, COSWP Chapter 17, IMO Resolution A.1050(27) and A Master's Guide to Enclosed Spaces.

It has been verified that the entry to enclosed space procedure was not considered or discussed by the Chief Officer with the Master in connection with this incident.

COSWP Chapter 17 states:-

“when it is suspected that there could be a deficiency of oxygen in any space, or that toxic gases, vapours or fumes could be present, then such a space should be considered to be a dangerous space. No one should enter a space where the atmosphere is unsafe or suspect without wearing breathing apparatus which they are trained to use, even to rescue another person.”

Entering an enclosed space without proper protective equipment, knowing the atmosphere is unsafe is a very foolhardy thing to do. It cannot be verified whether the Chief Officer was aware of the likelihood of oxygen depletion in the carriage of sawn timber or not. Evidence collated from the Company records indicates the Chief Officer had not carried a timber related cargo within the last four and half years.

It has been verified the cargo hold ventilation dampers were secured shut, and no mechanical ventilation had been run prior to his entry into the confined space. Contrary to the advice and guidelines contained in the aforementioned shipboard publications.

It therefore has to be considered the Chief Officer impulsively entered the space in order to investigate the problem with the cargo hold bilge tank sounding. He was not wearing any other protective equipment other than his normal safety working gear, nor was he wearing a portable oxygen meter. There were no posted warning signs at the entry to the cargo hold access.

2.8 Risk Assessment & Role of Safety Officer

As it has been determined from other crew statements, the Chief Officer entered the cargo hold access space of his own decision and without notifying any other crew member. In doing so there was no risk assessment involved in the process as part of the procedure for entry to an enclosed space. Therefore there was inherently a failure to assess the situation prior to entry and thus involve other crew members.

There are examples of generic risk assessment forms in use on board the ship, the form RAF No.8 specifically deals with an enclosed space entry. It is prepared and where necessary adapted to the particular task planned. The Chief Officer had last used a risk assessment form for an entry to an enclosed space as late as the 11th February 2015.

The form has a five stage process that involves;

- defining the hazard(s)
- risk calculation
- decide acceptability of the risks
- control measures and procedures to reduce the risk, and review risks and develop emergency procedures

The Chief Officer is also the ship's appointed Safety Officer. The officer had completed a Company specific training course in the role and duties of a Safety Officer. He had also fulfilled the role and duties of a Chief Officer on Company ships for a number of years. He had completed his shipboard familiarisation training prior to taking up his duties on board. The latter takes into account that he is familiarised with, the procedures for enclosed space entry and rescue from an enclosed space, explaining the H & S at Work policy, safe work permit arrangements and risk assessments. As such the evidence would suggest the officer had adequate knowledge and by definition be considered a "competent person";

Extract from the on board copy of IMO Resolution A.1050 (27) on the Revised Recommendations for Entering Enclosed Spaces Aboard Ships;

4.2 In order to ensure safety, a competent person should always make a preliminary assessment of any potential hazards in the space to be entered, taking into account previous cargo carried, ventilation of the space, coating of the space and other relevant factors. The competent person's preliminary assessment should determine the potential for the presence of an oxygen-deficient, oxygen-enriched, flammable or toxic atmosphere.

Furthermore his training would also be considered sufficient to undertake the role of a "responsible officer";

"A responsible officer is a person appointed to take charge of every operation where entry into a dangerous space is necessary. This officer may be the same as the competent person as noted above or another officer".

The above statements provide sufficient evidence to consider the Chief Officer was adequately trained for the purpose of identifying the hazards associated with entering an enclosed space, and as such the need for consulting a risk assessment. The Chief Officer has for whatever reason chosen to ignore the recommendations, guidelines and published information which was available to him in many areas of the ship.

The ship's Safety Committee Meeting records were examined on board during the investigation, noting that regular safety committee meetings were held on a monthly basis. It was further noted that a safety committee appointed and elected persons notice, was found posted on the ship's noticeboard.

2.9 Enclosed Space Entry Permit & Atmospheric Testing Equipment

There was no evidence of a "Safe Work" permit in use by the Chief Officer on the 13th March 2015.

There are however, examples of "Safe Work" permits form SWP in use on board the Sally Ann C. The last example of a permit in use prior to this incident was to inspect the After Peak ballast tank on the 11th February 2015. A risk assessment form was found attached to the back of this permit. The Chief Officer was in fact the authorising officer of the aforementioned safe work permit. So it stands to reason the officer knew of the shipboard procedures on entry to an enclosed space and how to use the relevant equipment.

The vessel is equipped with the following equipment for atmosphere checks prior to entry:-

- 1 x Draeger Accuro manually operated gas detector pump used for spot measurements with Draeger tubes and a 10metre length of sampling hose. The ship was equipped with tubes for the following gases inter alia, oxygen, carbon monoxide, carbon dioxide, methane, chlorine, hydrogen sulphide and nitrous fumes
- 2 x Draeger – Pac 3500 portable oxygen meters

The above meters were all type approved and working satisfactorily when inspected. They were utilised in this case to determine the presence of both oxygen and carbon dioxide levels in the cargo hold access during the on board investigation. Records on board indicate the meters are checked regularly in accordance with manufacturer's instructions.

Note there was no evidence the Chief Officer opened the ventilation dampers at cargo hatch No.3 or switched on the cargo hold ventilation system prior to entry at No.3 hold access.

2.10 Enclosed Space Rescue Drills

On the 1st January 2015 the IMO introduced amendments to SOLAS Chapter III Regulation 19 related to enclosed space entry and rescue drills. The background to this amendment came about due to the consideration that entry to enclosed spaces is a serious threat to life and personnel working on board ships. As previously ascertained above the SMS Section 11.4.21 Rescue from enclosed spaces, made provision for rescue operations in an emergency scenario.

There was evidence on board to note the Company had introduced entry to enclosed space drills as early as 2014 ahead of the planned IMO implementation.

Evidence on SMS form TDE, Table of drills and exercises, for the previous year 2014, notes six drills were carried out at approximately two monthly intervals. Similarly the drills matrix set for 2015 indicates the planned entry to enclosed space drill to be carried out bi-monthly. The ship's first drill for 2015 was completed on 10th January, and a further drill was planned for March.

The SMS Training, Drill and Instruction Log form TDL completed after the 10th January drill indicates a simulation drill was practised. There was no evidence of an actual tank entry as there was no safe work permit or risk assessment issued for that day or exercise.

Therefore it could not be determined, whether actual physical training takes place on board or whether it is purely a simulation type drill. That is either from inside an enclosed space which has been made safe prior to the drill, or from an open area on the ship simulating the difficulties of extraction of an injured crew from an enclosed space under realistic conditions; ie., a stairway and/or stairwell or vertical ladder. Neither was there a training “dummy” found on board for use during drill exercises.

2.11 The Rescue Operation

As previously noted above the SMS Section 11.4.21 Rescue from enclosed spaces, made provision for rescue operations in an emergency scenario. (see Appendix 5)

The rescue operation can be considered in two parts:-

1. The search and discovery of Chief Officer
2. The rescue of the Chief Officer, Chief Engineer and 2nd Officer

The Chief Officer was discovered lying unconscious at the base platform No.2 inside the access of No.3 cargo hold. This alarm was initially raised by the Deck Cadet on his VHF walkie talkie to the Master on the bridge. Evidence gathered during interviews with the crew note the discovery of the Chief Officer and the initial stages thereafter indicated the crew thought this was actually part of the drill. Some of the crew thought that as the Chief Officer was missing at the muster station, it was a deliberate ploy for a search and rescue drill. However, the Master made it clear in his instruction to the 2nd Officer, who in turn ordered the crew at the Muster Station to begin the search for the Chief Officer. It could be considered there was a potential for miscommunication at this point. However, at the time of the start of the search for the Chief Officer, he had been missing for almost an hour. Therefore the above point is not thought to be a contributory factor in the incident

The crew arrived quickly at the incident scene, and were then dispatched by the 2nd Officer to collect various pieces of rescue equipment, SCBAs, stretcher and other additional items required for the rescue operation.

The ship is equipped with four self-containing breathing apparatus sets as required by SOLAS Chapter II-2 Regulation 10.10., and Regulation 19.3.6.2. The latter regulation is provided for ships which carry dangerous goods.

The Chief Engineer arrived on scene and within a couple of minutes took it upon himself to enter the cargo hold access. He is heard by other crew present to shout out some “expletive” in his “mother” tongue (Russian language) before walking over to the access point and climbing in without wearing any proper safety equipment. At no point did any other crew shout a warning or attempt to stop him.

The actions of the Chief Engineer show a complete disregard for the shipboard procedures.

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The cries for “help” heard from the Chief Engineer almost immediately after entering the space and disappearing from view, were answered by the 2nd Officer. He took it upon himself to climb into the access to No.3 and enter the space. He was wearing a portable oxygen meter which went into alarm mode as soon as he had disappeared from view. He did not or could not evacuate the space on hearing the alarm and was himself quickly overcome by the depleted oxygen levels.

All three officers ended up on platform level No.2 practically on top of each other as described in the evidence provided by those crew who looked inside the space from above.

As soon as it was practical and safe, four of the crew donned SCBA equipment and entered the space carrying EEBDs for the unconscious officers. A harness and rope were lowered into the space to retrieve the first casualty. Each officer in turn was lifted out separately. An EEBD was placed on each officer in turn as and when the rescue team could safely reach the officer. However, it was noted from the interview evidence, that where there was no response each of the respective casualties in this instance.

The crew must be commended for their actions in this rescue operation. They managed the successful retrieval of all three officers from this confined space within a 15 minute period. That is from initial entry to the last person out. The actions of those officers, who became casualties, had left the more inexperienced crew to effect the rescue operation.

3. Conclusions:

The Company had failed to implement a detailed key shipboard operation into its safety management system, specifically in the area of enclosed space entry procedures

The failure of two senior ship's officers to follow simple documented procedures has resulted in their deaths, and the near death of another ship's officer.

None of the officers recovered from the cargo hold followed the current shipboard procedures or statutory guidelines and notices in respect of entry to an enclosed space.

There were no warning notices at the point of entry to the cargo hold access, either on the outside of the access lid or on the inside of the access lid.

The existing safety management system and shipboard operational procedures do not take into account the carriage of timber related cargoes and the dangers posed by oxygen depletion.

It has not been possible in this investigation to determine the exact decision processes reached by the Chief Officer to ignore normal shipboard procedures and practices to enter an enclosed space. The most plausible scenario is that he entered the space to investigate a possible problem concerning the cargo hold bilges, following higher than normal readings after the daily tank soundings.

The Master, other officers and crew cannot in anyway be held responsible for the actions of the Chief Officer, to act singularly and alone in his decision to enter an unsafe space.

Whatever reasons or motives the Chief Engineer and 2nd Officer had to enter an unsafe space has not been determined, other than the natural instinct of human behaviour in wanting to save a colleague, or colleagues without any thought to their own individual safety.

This incident needed just one member of the crew at the incident scene to stand up and just say “**No!**” However, the cultural behaviour of the crew was no doubt to accept the decision of someone more senior within the shipboard hierarchy.

The rescue operation was quickly and effectively executed by the remaining crew, who should be commended for their efforts. Despite no tripod hoisting equipment available on board to aid the rescue process, the casualties were extracted from the tank space without incident or delay.

It is of serious concern that despite the reaction of the crew on finding a person or persons in an enclosed space, two of the ship's officers persisted on entering a space totally unprepared for the consequences of their actions. This is despite the amount of shore training provision, the amount of shipboard training provision, and enclosed space rescue drills. The message about the dangers associated of entering such spaces has apparently still not permeated the human psyche.

It is always difficult to predict how different people may respond in a real emergency situation. Despite how well trained or experienced they are under normal conditions. The Chief Officer's decision to enter the access space without taking into consideration the appropriate safeguards goes against all his training. So do the impulsive actions of the other two officers to aid the Chief Officer, no matter how well intentioned they may have been.

4. Recommendations

The Isle of Man Ship Registry is recommended to:-

Issue this report and ensure its distribution to all Masters and ISM / Technical Managers with responsibility for Isle of Man registered ships. The report should also be distributed to the shipping industry as a whole, to highlight the inherent dangers associated with entry to enclosed spaces and in particular cargo hold spaces, no matter what type(s) of cargo they are carrying. It should highlight the importance of effective shipboard communication between crew members. The continued emphasis on familiarisation training of crew to the hazards associated with entry to enclosed spaces. The enhancement of enclosed space entry procedures and effective rescue drill training.

Re-issue an updated Merchant Shipping Notice No.23 - Entry to enclosed spaces and the dangers posed by oxygen depletion from timber cargoes.

Revise the Master's Handbook to highlight the dangers of entry to enclosed spaces; and precautions necessary for entry into a space where the atmosphere is known or is suspected to be unsafe.

Carisbrooke Shipping Limited is recommended to:-

Review their SMS and ensure procedures for entering an enclosed space are included as part of the key shipboard operations concerning the safety of personnel and the ship.

Review the SMS Cargo Operations procedures to include the provision of cargoes which are described as hazardous and / or oxygen depleting.

Review the familiarisation training and enclosed space entry procedures associated with all enclosed spaces on board vessels.

Ensure that suitable information about the loading, carriage and discharging of a hazardous and / or oxygen depleting cargo is promulgated to all crew.

Ensure that a risk assessment is carried out to identify all of the ship's enclosed spaces including cargo hold spaces and that they are correctly labelled with appropriate warning notices.

Ensure that all officers and crew are reminded as to the importance of effective communication in relation to all on going shipboard tasks.

Ensure that all persons who are required to enter an enclosed space positively identify the atmosphere condition(s) against the atmospheric parameters stated in the SMS for safe entry and provide appropriate conditions.

Ensure all Company vessels are supplied with a minimum of at least one oxygen analyser / multi gas meter and three portable oxygen meters. Following recommended guidelines in the MSC./1Circ.1477 – in order to facilitate the selection of portable atmosphere testing instruments for enclosed spaces as required by SOLAS regulation XI-1/7.

Ensure additional rescue equipment is supplied to Company vessels eg. a tripod for portable lifting and recovery of a casualty and the use of a realistic "dummy" for use in rescue drills.

Sally Ann C – Enclosed Space Fatalities and Near Fatality

The Ship Registry is satisfied that Carisbrooke Shipping have taken the appropriate steps prior to the issuing of this report to amend and issue new procedures to avoid a re-occurrence of this incident so far as possible, and meet all the recommendations as noted in the casualty report.

Safety recommendations shall in no case create a presumption of blame or liability.

Appendix 1

Extract of the current Merchant Shipping Notice 023 – June 2007

Following a fatal incident on board an Isle of Man flagged ship we must reiterate the dangers of entry into enclosed spaces without ensuring the atmosphere is safe for entry. This Shipping Notice is also to highlight the danger posed by timber logs in cargo holds causing a depletion of oxygen in the atmosphere.

Documents:

The incident occurred on a vessel carrying a cargo of coniferous pulp logs. During cargo operations a closed cargo hold was entered by a crew member via an access hatch. When it was realised that the crew member was missing, a search of the ship discovered him in the hold and before a rescue could be arranged the Master entered the hold through the same access hatch and was also overcome by the oxygen depleted atmosphere. The bodies of both crew members were recovered by a rescue party using breathing apparatus.

Preliminary findings have shown:

1. While the dangers of oxygen depletion caused by timber logs was known to the crew there was no procedure to cover cargo operations and the dangers posed by this type of cargo.
2. Subsequently the cargo hold was not treated or marked as an enclosed space, with no warning not to enter without checking the atmosphere.
3. Mechanical ventilation of the holds was provided but not used.
4. Initial rescue of the two persons was attempted using only a Charcoal filter mask which almost resulted in another death.

This incident has highlighted deficiencies in the operation and planning of the cargo hold entry procedures on board the vessel, especially when carrying cargoes that cause oxygen depletion, and raises concerns over the control of routine cargo operations.

It is strongly advised that all personnel responsible for, and taking part in, enclosed space entry procedures should take note of the following:

1. Filter masks should never be relied upon to support life in atmospheres which are deficient in oxygen or contain toxic and/or flammable gas.
2. Companies should review their enclosed space entry procedures and ensure that they are adhered to at all times by all personnel. All crew members must be made aware of the necessity to ventilate spaces and to check the atmosphere in a space prior to any decision to enter being made, by a responsible officer. As an absolute minimum, the requirements of the "Code of Safe Working Practices for Merchant Seamen" Chapter 17 must be followed at all times.
3. Enclosed Space Entry Permits must be used and the procedures required by the Permit must be strictly followed at all times before entry is allowed.
4. For vessels engaged in this trade we wish to point out that there have been another seven fatalities in the last year on vessels of various flags trading to Baltic countries with crew members entering unventilated spaces carrying timber products. The dangers posed by these products cannot be overemphasised and we require that all Companies involved in the carriage of these cargoes review their current cargo operations procedures to ensure the dangers are known to all on board and steps are in place to avoid a similar tragedy.

Appendix 2

Narrative from TSO 46 – Entry to enclosed spaces (Dated 16th May 2013)

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The Company has recently been made aware of an increasing number of instances where required procedures for Entry into Enclosed Spaces are not implemented and / or followed.

This is of great concern, as ignoring procedures put in place to safeguard the health and life of personnel working on board our ships, could lead to tragic consequences including fatalities.

Two of the reported cases referred to, concerns in summary, as follows:

1. During Class Surveys inspection of a tank was required. The Chief Officer did not implement or follow enclosed space entry procedures. No safety equipment was available and no crewmember with communication was on stand-by at the entrance. The ship was issued with a PR17, which is a report automatically submitted to the Flag State. The ship has since had to undergo two additional external audits due to the failure of following procedures and carry out appropriate onboard training. No need to say, neither the Company nor the Flag Administration are satisfied with the conduct of the ship's officers, in particular, who allowed this situation to arise.
2. While conducting a scheduled audit the MCA surveyor enquired about cleaning and maintenance of fresh water tanks. The MPM records were provided. On cross checking these records with work permits and risk assessments it very soon transpired that of FIVE entries into the fresh water tanks only ONE work permit / risk assessment was available on file, clearly indicating that enclosed entry procedures had not been followed. The ship was issued with a Major Non-Conformity, and was not permitted to leave port until the Company had provided details of corrective and preventative action and the N/C had been downgraded. Not only was / is this embarrassing for the Company and the senior officers employed on its ships, but it also disappointingly indicates that despite increased frequency of training and emphasis on safe work practices, procedures are not observed and followed.

Recent reports from a P&I Club confirm that "Confined/enclosed spaces do not only continue to take their toll, but are on the increase despite recent measures to reduce such incidents and despite the wealth of information available, many deaths have been caused by seafarers being unaware of or ignoring the correct procedures prior to entering an enclosed space".

Our Company has already got procedures in place, including work permits and risk assessments as well as appropriate reference material, to ensure as far as possible the safety of personnel planning to and working within enclosed spaces. However, in light of the cases reported above, it is evident that these are on occasions ignored by ships' officers who principally are responsible for the safety of all members of crew undertaking such work.

This is not only considered to be unprofessional, but is also totally unacceptable. The Master on every ship shall with immediate effect arrange a training session with all officers and crew addressing the contents of this Standing Order. It shall also be reiterated during the training that at every scheduled quarterly enclosed space entry a risk assessment is conducted and a work permit issued. Reference must also be made to procedures in the Code of Safe Working Practices for Merchant Seamen (COSWP, Chapter 17) and A Master's Guide to Enclosed Space Entry (The Standard) (both already in the ship's library) and to IMO Resolution A27/Res.1050 (Revised Recommendations for Entering Enclosed Spaces Aboard Ships) attached with this Standing Order.

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A TDL shall be completed with detailed description of the training and the names and signatures of all attending crew. Additionally, the attached poster shall immediately be printed in several copies, laminated and displayed in various locations around the ship, including as a minimum the bridge, engine control room and all mess rooms. A3 size posters will follow in ship's mail in due course.

Appendix 3

Extract of Risk Assessment Procedures

5.14 RISK ASSESSMENTS

The Company has supplied all ships with a set of standard risk assessments. These risk assessments cover the key shipboard operations and all crew shall be fully familiar with the specific risk assessments and the associated control measures relevant to the task(s) being performed. Whenever a job is to be carried out, the appropriate risk assessment(s) are to be consulted and, where appropriate, a Safe Work Permit completed.

It is possible that new work tasks are required or new / replacement equipment is provided on board which are not covered by the standard set of risk assessments. Under these circumstances, a new risk assessment, or a review of an existing risk assessment will need to be conducted on board.

A risk assessment is an examination of the work process to be followed in order to:

1. Identify the hazards
2. Evaluate the risk(s) associated with each identified hazard
 - a. Severity of the hazard;
 - b. Likelihood of the hazard happening;
 - c. Initial risk factor calculation.
3. Identify appropriate control measures
4. Re-evaluated the risk(s) associated with each identified hazard
 - a. Severity of the hazard;
 - b. Likelihood of the hazard happening;
 - c. Re-calculation of the risk factor.

The Company's maximum permitted final risk factor is Medium Risk. However, every effort must be made to reduce all risk factors to the lowest possible level (aim for zero risk level). All new or revised risk assessments on board are to be conducted using the Company's Risk Assessment Form (RAF) and sent to the office for review and, where appropriate, inclusion in the standard set of risk assessments.

The standard set of risk assessments are to be reviewed at each Shipboard Management Review (SMR), with a random (and different) twenty percent (20%) of the standard set being reviewed at each SMR.

Appendix 4

Extract of Safe Working Permit Procedures

5.12 SAFE WORK PERMITS

Prior to carrying out any repairs or inspections in certain areas, including but not limited to enclosed or confined spaces, chain locker, working aloft or overboard, hot work or maintenance or repair work to machinery or equipment, as defined in the Code of Safe Working Practice for Merchant Seamen (CoSWP), standard Safe Work Permits must be completed (form SWP).

The work permits are intended to ensure that all necessary safety precautions have been taken, and personnel involved in the work properly informed and prepared, before any potentially hazardous work starts. Safe Work Permits are only valid for a maximum period of 24 hours. However, if the work cannot be completed in one go (e.g. need an overnight break) then the Safe Work Permit must only be valid for the duration of the shift, and a fresh Safe Work Permit properly completed when the job is resumed.

On completion of hazardous work the Work Permit should be completed and signed off by the person in charge, normally being one of the Heads of Department.

In case of shore based personnel executing the work, or shore based work authorisation having been obtained for work to be executed by shipboard personnel, the ship should normally receive a written permit from ashore. This permit must be handled and kept on file in the same manner as the company's SWP. If shore based personnel do not complete their own permit, or no permit is received along with shore authorisation, prior to starting the work, the Company's own SWP must be completed.

Appendix 5

Extract from Procedures for rescue from enclosed spaces

11.4.21 Rescue from enclosed spaces

Each ship should have a plan of action for the rescue of a person collapsed within an enclosed space. The design of the ship and allocation of personnel should be considered.

In the event a person is injured or affected by the atmosphere in an enclosed space:

1. Raise the alarm immediately to summon help;
2. Inform the Master;
3. Never enter the enclosed space until additional help has arrived;
4. Always assume that the atmosphere in the space is unsafe;
5. Members of rescue team must put on breathing apparatus before entering;
6. If required wear a rescue harness and / or a lifeline;
7. Breathing apparatus or resuscitation equipment should be fitted to casualty if possible;
8. Move casualty to safe area outside the enclosed space and give required treatment.

For further information refer to procedures in the Code of Safe Working Practices for Merchant Seamen. If required, follow procedures for Medical emergencies and Helicopter operations listed in this Section.

Appendix 6

Upper Deck Plan of Incident Scene - No.2 / 3 Cargo Hatch Recess

F	S.No.	6
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UPPER DECK PLAN

