Isle of Man Ship Registry

Casualty Investigation
Report No. CA118

Isle of Man Registered "Sharp Lady"

Enclosed Space Fatality and Near Fatality

23rd August 2013

Contents

Foreword

The fundamental purpose of investigating a casualty, an accident or an incident under the Regulations[1] 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 help and assistance during this investigation;

- Australian Maritime and Safety Authority (AMSA)
- Officers and crew of the Sharp Lady
- Scinicariello Ship Management S.p.A

"*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 difficulties, but far too many additional and unnecessary casualties have occurred from impulsive and ill-prepared rescue attempts*."**

ISGOTT Ed V Ch 10

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

Abbreviations Used In This Report

2/O	Second Officer
3/O	Third Officer (two third officers are on board)
3P	Number 3 Port – referring to the cargo oil tank
AB	Able Bodied Seaman
ALRS	Admiralty List of Radio Signals
AMSA	Australian Maritime and Safety Authority
BA	Breathing Apparatus
ºC	Degrees Celsius
CO	Carbon Monoxide
COSWP	Code of Safe Working Practices for Merchant Seamen (Consolidated Edition, 2010) by the United Kingdom maritime and Coastguard Agency published by The Stationery Office.
CPR	Cardiopulmonary Resuscitation
DPA	Designated Person Ashore (ISM Code Part 4)
GT	Gross Tonnage
EEBD	Emergency Escape Breathing Device
H2S	Hydrogen Sulphide
HC	Hydrocarbon vapour
IG	Inert Gas - A gas or a mixture of gases, such as flue gas, containing insufficient oxygen to support the combustion of hydrocarbons.
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 Harbors.
IMO	International Maritime Organisation
Kts	Knots measured in Nautical Miles per hour
LEL	Lower Explosive Limit - The concentration of a hydrocarbon gas in air below which there is insufficient hydrocarbon to support and propagate combustion. Sometimes referred to as Lower Flammable Limit (LFL).
LMT	Local Mean Time
m, m³, cm	Metres, cubic metres, centimetres
MSDS	Material Safety Data Sheet
nm	Nautical Miles (1nm=1852 metres)
O2	Oxygen
OS	Ordinary seaman
PPM	Parts per million
RCC	Rescue Coordination Centre
RPM	Revolutions per minute
SD	Statutory Document
SMS	Safety Management System
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 Coordinated Time
VHF	Very High Frequency

Author's Note

To avoid any confusion throughout this report the term "tank bottom" is used to refer to the bottom of the cargo oil tank. This term should be treated as synonymous with the term "tank top" which refers to the top of a ship's bilge tank or double bottom, usually the lowest horizontal surface on board. See diagram on page 10 for clarification.

Summary

Sharp Lady – 3P Cargo Oil Tank – tank access hatch

On the 9th August 2013 the Isle of Man registered crude oil tanker “Sharp Lady” departed the port of Geelong, Australia on a ballast passage bound for an offshore oil terminal in Indonesia. Prior to departure during cargo discharge operations an oil sampler broke and fell to the bottom of the tank. It was planned to retrieve the sampler from the empty tank on passage to Indonesia when weather conditions permitted.

On the 23rd August 2013 it was decided to enter the cargo tank to retrieve the broken sampler. The Chief Officer and Cadet entered the cargo tank after an Enclosed Space Work Permit and Risk Assessment had been completed. When the Chief Officer and Cadet reached the bottom of the cargo tank they felt debilitating effects of hydrocarbon vapour present at the lower level of the cargo tank. Both the Chief Officer and Cadet attempted to activate their Emergency Escape Breathing Devices and exit the cargo tank. The Master observed the Cadet in difficulty and quickly entered the tank ignoring the advice of a fellow crew member. The Chief Officer successfully exited the cargo tank but the Cadet had collapsed unconscious on the tank bottom. When the Master reached the tank bottom to aid the Cadet he was overcome by hydrocarbon vapour and collapsed.

The alarm was raised and a rescue was quickly initiated. The Master and Cadet were retrieved from the bottom of the cargo tank and brought to the main deck were first aid was administered.

The report concludes that the Master died and the Cadet was injured as a result of entering the cargo tank containing a concentration of hydrocarbon vapour at the bottom of the cargo tank. The ship’s safety procedures for enclosed space were not fully complied with and the risk posed by the hydrocarbon vapour measured in the cargo tank was not appreciated by those involved in the tank entry preparations.

The report also concludes that opportunities were missed on board to stop the tank entry by several crewmembers and that the death of the Master could have been prevented had the safety procedures on board been followed in full.

This case does not present the need for a change to any regulations (ref. SOLAS I/21a).

Ship Particulars – Sharp Lady

Source: blenheimshipping.co.uk

Ship Particulars
Flag – Isle of Man (British)
Port of Registry – Douglas
Ship Type – Crude Oil Tanker
Official No. – 742824
IMO No. – 9577044
Year of Build – 2011
Call Sign – 2EKQ4
Owner – Blenheim Shipping UK Ltd
Technical Managers – Scinicariello Ship Management S.p.A
Classification Society – Lloyds Register of Shipping
Length – 249.9m (overall)
Beam – 44.0m (moulded)
Depth – 21.5m (moulded)
Summer Draught – 15.12m
Sailing Draught – Fwd 6.4m, Aft 8.4m (departure Geelong 9th August 2013)
Gross Tonnage – 64089
Net Tonnage – 35252

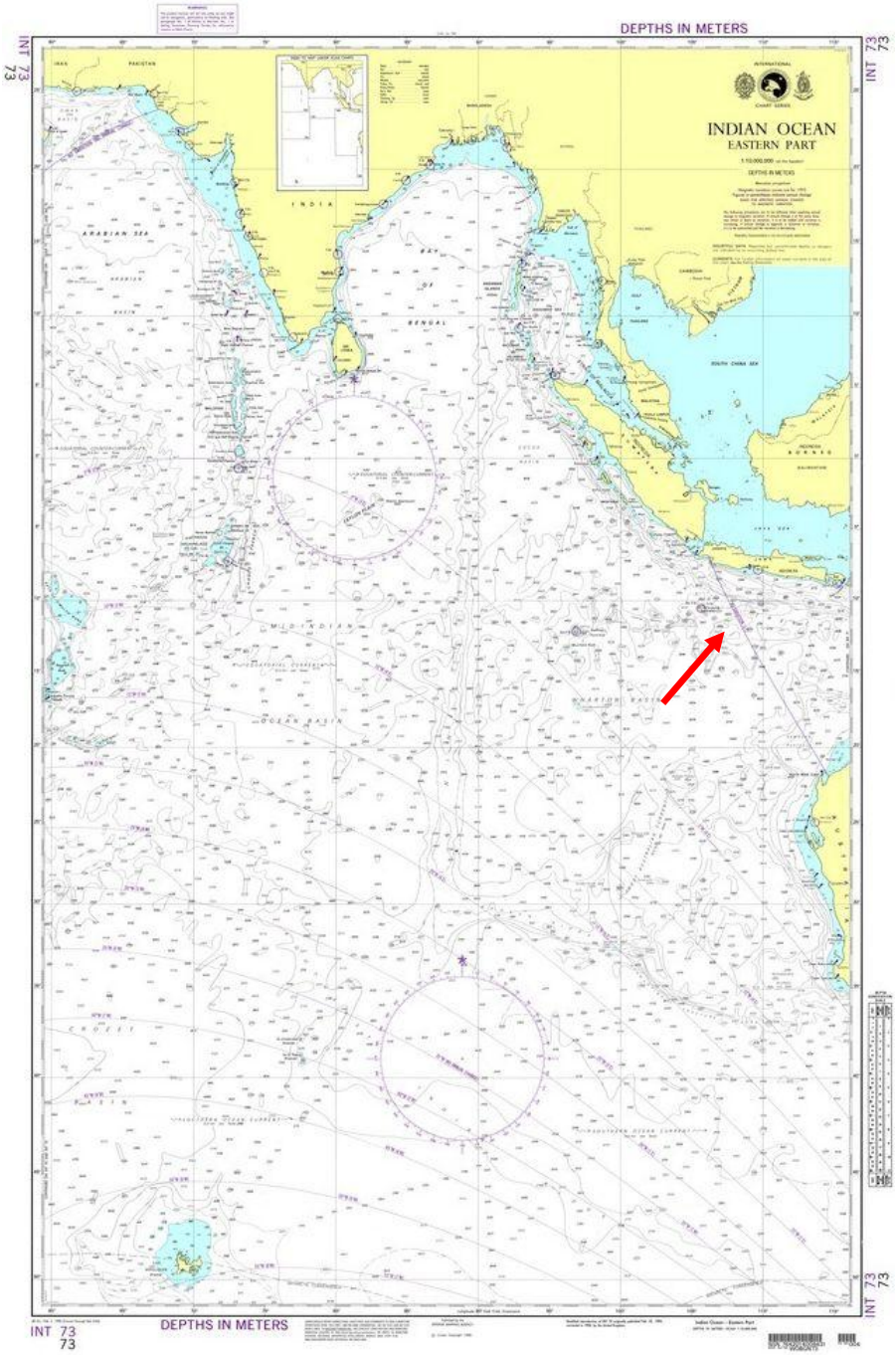
Casualty Details
Date / Time – 23rd August 2013 / 1040 Ship Time (UTC+7hrs)
Classification – Very Serious Casualty
Location – at sea Indian Ocean
Vessel Status – underway and making way - approximately 12.5 knots.
Injuries / Fatalities – 2 / 1
Vessel damage – none
Crew Complement – 22 including the Master (all Pakistani nationals)
Cargo on board – none – ballast passage.

1. Narrative of Events

The following is a narrative of events based on the Sharp Lady's crew actions. This narrative is based on interviews with those involved and evidence collected on board the Sharp Lady. All times are the Sharp Lady's ship time (UTC +7hrs).

1.1 Location of Casualty

Indian Ocean, Eastern Part



Section of Chart INT73 – "Indian Ocean Eastern Part". Reproduced by permission from the UK Hydrographic Office.

Environmental Factors - Weather: no precipitation
Temperature: 28°C
Wind: SE beaufort force 5
Visibility: Good

1.2 Sequence of Events
All times are ship time (UTC+7hrs)

3 Port Cargo Oil Tank main deck area

Mast Riser

Mast House

3P Tank forward tank hatch

3P ullage point
(where oil sampler broke)

3P aft sounding and ventilation point

3P Tank access hatch

4th August 2013

The vessel is in the port of Geelong, Australia discharging crude oil cargo. When taking oil samples of the cargo the sampler tape snapped when taking a sample of 3P oil cargo through the sampling port. The sampler bucket then fell to the tank bottom. Sampling operations were then ceased.

It was decided later that when cargo discharge and crude oil washing was complete and the vessel sails from Geelong the sampler would be retrieved. It was felt necessary to retrieve the sampler before loading the next oil cargo in 3P to avoid any potential damage to the ship's equipment from the sample bucket or sample tape. See appendix 1 for an example of the ship's oil sampler on board.

9th August 2013

Vessel departs Geelong bound for passage to an offshore oil terminal in Indonesia via Sunda Strait.

Heavy weather is encountered on passage preventing the crew working on deck until the 20th August 2013.

The job of gas freeing 3P cargo oil tank in order to retrieve the sampler is discussed at the weekly work plan meeting on the 18th August 2013 and the daily work plan meetings from the 19th August 2013 onwards. The job is reviewed daily until weather conditions permit the crew to work on the main deck safely.

20th August 2013

Ventilation of 3P cargo oil tank commences through forward and aft openings on the main deck. Ventilation is achieved by 'hydrodrive' fans powered by the fire main attached to 15m air ducts hanging vertically down into the tank (tank height is approximately 20m). The tank access hatch is opened approximately 3 inches.

21st August 2013

During his morning deck rounds the Chief Officer measures the tank atmosphere of 3P cargo oil tank using an explosimeter and sample hose. O2 19% HC57%LEL H2S 0. (O2 level came from Chief Officers recollection).

22nd August 2013

During his morning deck rounds the Chief Officer measures the tank atmosphere of 3P cargo oil tank using an explosimeter and sample hose. O2 19.6% HC38%LEL H2S 0.

1730 Daily work meeting held with 2nd Engineer, Chief Officer, Electrician and Pumpman. Tank entry into 3P Cargo oil tank is discussed. It was agreed that tank entry into 3P tank will commence in the morning if the gas levels are "less".

23rd August 2013

0800 3/O(1) relieves 3/O(2) of navigation watch duties on the bridge.

Chief Officer issues jobs to the deck crew and then takes a walk around the vessel.

0900 Chief Officer measures the tank atmosphere of 3P cargo oil tank using an explosimeter and sample hose. O2 20.6% HC26%LEL H2S 0.

Chief Officer briefs the Pumpman to prepare equipment at 3P tank access hatch and open the tank access hatch for tank entry later in the morning. BA sets, EEBDs, Stretcher and heaving lines are placed in the vicinity of the tank access hatch.

3/O(1) observes from the bridge tank entry preparations at the entrance of 3P tank access hatch .

The Chief Officer then completes the Risk Assessment and Enclosed Space Work Permit in the ship's office.

1000 At morning coffee break in the ship's office the Chief Officer advises 3/O(2) that he will probably go in 3P cargo oil tank after coffee break to retrieve the sampler. The 3/O(2) is instructed he will stand by the 3P tank access hatch during this operation. The Chief Officer states to the 3/O(2) that the permits have been completed stating "everything is ok".

1015 Chief Officer measures the tank atmosphere of 3P cargo oil tank using an explosimeter and sample hose. O2 20.7% HC26%LEL H2S 0.

1020 Chief Officer goes to Master's cabin to discuss the tank entry and presents the Risk Assessment and Work Permit for enclosed space entry to the Master. The Chief Officer states the atmosphere readings of O2 20.7% HC 26%LEL H2S 0 to the Master.

Master: "the 26% will not get down more, O2 is ok. Go in with EEBD and it will be ok".
Chief Officer: "are you sure it's ok?"
Master: "take another sharp person with you"
Chief Officer: "[Cadet]?"
Master: "yes good choice"

Master calls 3/O(1) on the bridge to inform him that he is proceeding to the main deck.

1025 The Master signs the Enclosed Space Work Permit for time of 1030 and the Enclosed Space Entry Risk Assessment. Chief Officer and 3/O(2) proceed to 3P cargo oil tank

access hatch where the Chief Officer inspects the equipment at 3P tank access hatch . 3/O(1) observes the crew assembling at 3/P tank access hatch .

The Chief Officer tests the tank atmosphere using the atmosphere testing equipment (“explosimeter”) and sample hose lowered into the tank at 3P tank access hatch. Chief Officer instructs 3/O(2) ”just observe and report to the bridge”.

Chief Officer briefs Cadet on safety when inside the tank:-

1. Oxygen is ok.
2. If personal gas alarm sounds put on EEBD and get out quick
3. Be careful not to slip over.
   [No other items from either the risk assessment or enclosed space work permit are discussed with the Cadet.]

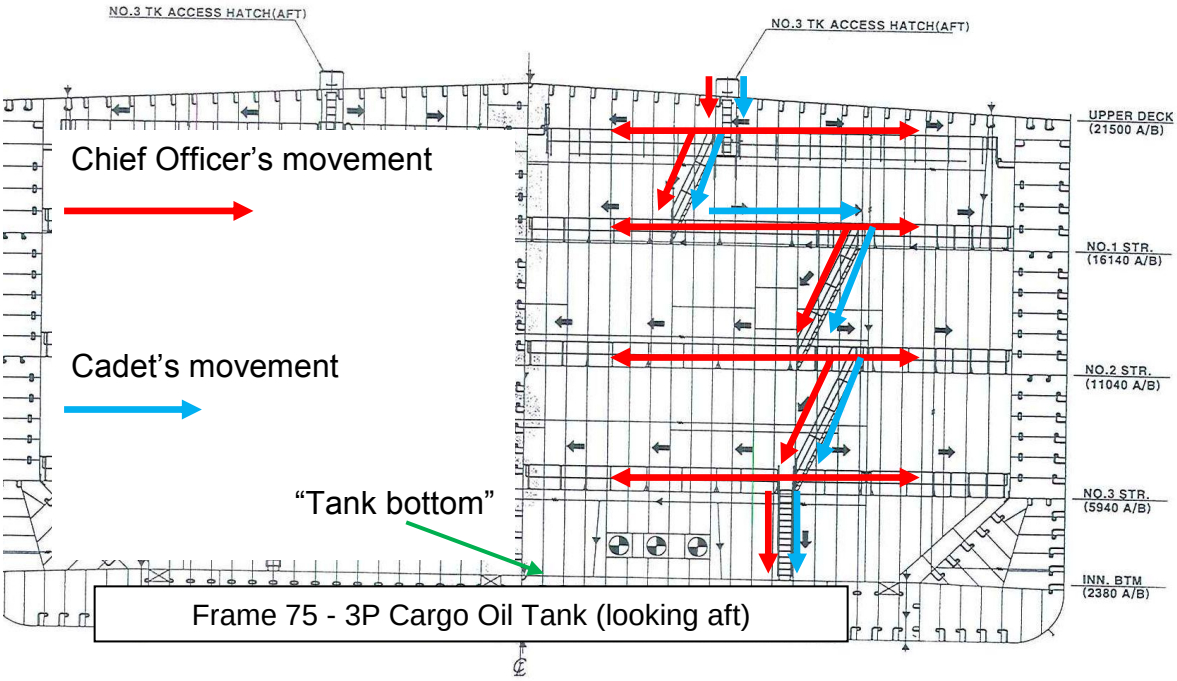
1030 The Master arrives at 3P tank access hatch and discusses the procedure with the Chief Officer.
Master: “Stay on each platform, check the gas then proceed”

The Chief Officer briefly measures the tank atmosphere again. The Chief Officer then informs 3/O(1) on the bridge of the tank atmosphere readings O2 20.7%, HC 26%LEL, H2S 0.

1035 Chief Officer and Cadet enter 3P cargo oil tank via the tank access hatch each with an EEBD worn over the shoulder, a torch and a personal gas meter. Master, 3/O(2), Pumpman and two ABs in attendance at tank access hatch . The Chief Officer has a VHF radio has instructed the 3/O(2) not to contact him when in the tank.

The Master and 3/O(2) proceed to the forward tank hatch opening to observe the Chief Officer and Cadet’s progress. The 3/O(2) uses mirror to reflect extra light into the tank space for additional illumination.

The diagram below depicts the movement of the Chief Officer and Cadet in 3P Cargo Oil Tank. The Chief Officer proceeds first, he climbs down onto the first platform and checks the atmosphere across the platform with the personal gas meter. The Cadet then proceeds down the stairs to meet him. This is repeated for the remaining platforms until No 3 Str platform.



Care is taken not to slip over by the Chief Officer as per the advice previously discussed at the tank access hatch. [The tank is generally reported to be clean with a few minor oil patches in some corners following the Crude Oil Washing Operations in Geelong.]

From the No. 3 Str platform the Chief Officer climbs down the ladder onto the tank bottom first followed soon by the Cadet.

1039 Chief Officer and Cadet reach the tank bottom. Chief Mate feels dizzy and hears his personal gas meter alarming. The Cadet reaches the tank bottom and instantly feels the effects of the gas inhalation. The Cadet hears his personal gas meter alarming. The Chief Officer shouts and gestures to the Cadet to wear his EEBD and leave the tank. The Chief Officer feels dizzy and shocked by the events and immediately proceeds to exit the tank.

3/O(2) observes cadet in difficulty standing in an abnormal style and informs Master. The Master instructs the 3/O(2) to inform 3/O(1) on bridge and runs to the tank access hatch.

The Cadet attempts to don his EEBD and activate it.

1040 Master starts to enter 3P tank with an EEBD worn over his shoulder. Pumpman shouts at Master advising him not to enter the tank but Master ignores the Pumpman and proceeds into the tank.

The 3/O(2) prepares the emergency equipment already available at the tank access hatch and helps the two ABs don the BA sets already available at the entrance.

1042 Cadet collapses and lies on the tank bottom approximately 3m from the bottom of the ladder while Chief Officer is heading towards the exit. The Chief Officer notices someone quickly run passed him [the Master] on No 2. Str platform.

1042 Chief Officer exits 3P tank, Master arrives at the tank bottom and collapses at the bottom of the ladder. 3/O(2) reports Master and Cadet are both lying on the tank bottom.

1042 The general alarm is raised. Crew members instructed to proceed to 3P tank for an enclosed space rescue over the public address system. Crew members proceed to 3P tank access hatch bringing additional rescue, medical equipment to prepare for tank rescue of Master and Cadet.

1052 The Chief Engineer takes charge of the rescue operation.

The 2nd Engineer arrives at 3P Tank access hatch already wearing a BA set. The 2nd Engineer briefly discusses the rescue plan with the Chief Engineer and both agree the 2nd Engineer and two ABs will enter the tank each wearing BA sets and evacuate the casualties by stretcher.

3 crew members enter tank with BA sets – 2nd Engineer first followed by two ABs.

The rescue party reaches the tank bottom. The 2nd Engineer quickly evaluates the scene observing the presumably unconscious Master (pale yellow complexion and no movement) with EEBD over his shoulder and the presumably unconscious Cadet with the EEBD hood halfway over his head with air activated. The Cadet shows signs of sporadic movement.

The 2nd Engineer decides to evacuate the Master first because the Cadet has been receiving air from the EEBD set. The 2nd Engineer notices a Neil Robertson stretcher, BA set and compressed air hose has been lowered down to the tank bottom through the forward tank hatch. The Master is moved to beneath the forward tank hatch and secured in a Neil Robertson stretcher. Air is also being blown into the Master's face (under his nose)

from the compressed air hose whilst being secured into the stretcher.

The 2nd Engineer gives a hand signal for the Master to be raised to the main deck. All available crew on the main deck pull the gantline raising the Master to the main deck. The 2nd Engineer notices the Cadet's EEBD air supply is about to expire. The 2nd Engineer fits the Master's EEBD on the Cadet and activates the air supply.

1100 The Master is retrieved to main deck area through the forward tank hatch secured in Neil Robertson stretcher. Master appears to be unconscious – no signs of a pulse and breathing are detected on the Master. 2/O commences first aid on Master – mouth to mouth resuscitation and chest compressions.

An additional Neil Robertson stretcher is lowered down to the tank bottom. The Cadet is secured in the Neil Robertson stretcher and then raised to the main deck. As the Cadet is raised out he has his EEBD removed by the 2nd Engineer.

The 2/O puts a resuscitator on the Master where medical oxygen is given via a facemask.

The 2nd Engineer hears one of the AB's low level alarms sound on the BA set. The 2nd Engineer orders the rescue party out of the tank. As the rescue party begin to make their way out of the tank the BA low pressure alarm sounds on 2nd Engineer's and other AB's BA sets.

1105 Cadet is retrieved to main deck area through the forward tank hatch secured in a Neil Robertson stretcher. The Cadet appears to be unconscious, twitching with yellow foam emanating from his mouth.

3/O(1) begins locating emergency contact details for shore based support from ALRS.

2/O reports to 3/O(1) that Cadet is breathing erratically and the Master is showing no signs of life. The 2/O cleans the Cadet's mouth of foam.

Medical oxygen is given to the Master through a resuscitator and facemask.

1125 Chief officer and 2nd Engineer reach the bridge to get emergency contact numbers. Chief Officer telephones company DPA and the crew agency from the Master's cabin.

Chief Officer initially calls RCC Jakarta where he is then transferred from department to department in the organisation. RCC Jakarta advises to call RCC Australia as the vessel was in Australian territory.

Chief Officer calls RCC Australia concerning radio medical advice and medical evacuation.

Email communication is initially hampered since the ship's crew cannot get access to the vessel's email system as the password is known only to the Master. Email communication is subsequently established through the 2nd Engineer's personal email address through the ship's internet system.

1135 3/O(1) alters vessel's course to nearest land of Java Island, Indonesia. Vessel RPM is increased.

1148 The Master and Cadet are transferred to ship's hospital by Neil Robertson stretcher. First aid administered to Master and Cadet by the 2/O and crew members.

1200 Master – no pulse found by crew. Cadet beginning to respond to treatment. The 2/O verifies the symptoms relayed from the MSDS sheets from the 3/O(1) on the bridge.

1204 The Cadet is gaining consciousness and vomiting.

1212 Cadet opened eyes and awareness gradually improving. The Master's pulse and body temperature are frequently being checked.

1220 No pulse detected on Master. Medical oxygen and chest compressions still being administered to the Master.

1226 Vessel alters course towards Christmas Island, Australia. Vessel RPM increased further. Cadet is conscious and asking for water.

1232 Contact made with Australian RCC, informed helicopter is coming for medical evacuation. Crew informed to prepare for helicopter landing.

1247 Cadet is talking to crew members.

1300 Cadet condition improving further but is still vomiting. Master condition further deteriorating – no pulse, body temperature falling. CPR, medical oxygen, warming through massage and blankets is continuously administered to the Master.

3/O(1) provides advises 2/O of symptoms of cargo vapour inhalation and treatment from cargo MSDS sheet.

Cadet is given small amounts of water on advice of shore based medical and is taken outside to sit in the fresh air.

1330 Chief Officer officially takes command of the vessel.

1332 Vessel alters course towards Flying Fish Cove on the advice of Australian RCC. Vessel is advised that a boat will be in attendance on arrival at Christmas Island. Crew abandon helicopter landing preparations as no helicopter is available from Christmas Island.

2/O frequently reporting condition of the Master to 3/O(1).

1447 CPR, medical oxygen, warming through massage and blankets is continuously administered to the Master.

Shore doctor states that it is likely the Master has died. The crew continue to administer CPR, medical oxygen, warming through massage and blankets in hope of the Master's recovery.

1515 All medical oxygen on board has been used. CPR and warming through massage and blankets continues to be administered to the Master.

1600 Medical treatment of the Master is discontinued.

2148 Vessel arrives at Christmas Island where Australian Police and Customs board the vessel. The Master's body was taken ashore by launch boat.

The technical managers email all oil tankers under management not to enter cargo oil tanks until further notice without permission from the company.

25th August 2013

Some rescue equipment left inside the tank (1 SCBA, 1 EEBD) during the emergency and the sampler are retrieved with permission from the technical managers. An enclosed space entry permit and risk assessment was completed. Crew were instructed to wear BA sets when in the tank.

1.3 Injuries to Crewmembers

Master

Overcome by hydrocarbon vapour and collapsed. Pronounced dead on board following shore based medical advice.

The results of the post mortem examination are pending. Prior to the results of the post mortem examination being released it is reasonable to assume at this stage the Master succumbed to environmental asphyxia.

Deck Cadet

Overcome by hydrocarbon vapour, felt dizzy before collapsing unconscious.

When coming to the Cadet felt nauseous and frequently vomited.

Chief Officer

Felt dizzy in the cargo oil tank when he inhaled the hydrocarbon vapour. Quickly recovered when he returned to the fresh air on the main deck.

2. Comment and Analysis

Foreword

This section aims to analyse the factors affecting the crewmen, the preparation of the cargo tank before entry, why the crewmen entered the space and the technical manager's procedures governing access to enclosed spaces. The rescue is also assessed for its effectiveness.

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

2.1 The Injured Crewmen

Master (deceased)
50 years old, he has over 21 years sea experience, over 11 years as Master and 13 years sailing on crude oil/product tankers. The Master was very experienced and respected by his shipmates.

The Master holds a valid United Kingdom Certificate of Competency STCW II/2 Master Unlimited with oil tanker endorsement. All other statutorily required certification including medical certificate was inspected and found in order.

During interviews with the crew members on board some of the crew had witnessed the Master act impulsively on occasion with good intentions in order to get the job done.

Deck Cadet (Injured)
22 years old. Has sailed on the vessel since April 2012 (16months) as part of his cadet training programme. The Cadet had Certificates of training regarding STCW Tables A-VI/1-1 to 1-4 and a valid medical certificate.

Chief Officer (Injured)
37 years old, he has over 98 months sea experience, 3 months experience as Chief Officer and 54 months sea experience sailing on crude oil/product tankers. This was the Chief Officer's first trip sailing in the capacity of Chief Officer.

The Chief Officer holds a valid United Kingdom Certificate of Competency STCW II/2 Master Unlimited with oil tanker endorsement. All other statutorily required certification including medical certificate was inspected and found in order.

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 includes training requirements for entry into enclosed spaces. All Officers and crew had completed their on board familiarisation training when boarding the ship which included (inter alia) use of BA sets, work permits and protective clothing.

There was no evidence to suggest that Master, Cadet, Chief Officer or any other crew member was suffering any ill effects from fatigue, alcohol or drugs.

2.2 Cargo Carried

The cargo carried in 3P cargo oil tank prior to entry was 6880t of Murban Crude Oil. Crude oil consists largely of hydrocarbons. The crude oil cargo was discharged on 09th August 2013 and the cargo oil tank was also crude oil washed during discharge. The Material Safety Data Sheet (MSDS) supplied for the oil cargo stated:

Health Hazards *(inter alia);*
Inhalation: may cause nervous system effects, nausea and vomiting

Preventative measures *(inter alia);*
Engineering controls: general exhaust ventilation adequate

First Aid Measures*(inter alia);*
Inhalation: remove victim to fresh air, administer oxygen or artificial respiration if breathing has stopped. Keep person warm and rested, obtain medical advice.

2.3 Is the Cargo Tank an "Enclosed Space"?

Under the SMS;
"*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 where are identified all the enclosed spaces*"**

The SMS definition of an enclosed space is consistent with the definition of an enclosed space stated in ISGOTT Ed V Ch 10.
ISGOTT Ed V Ch 10 also states;
"*During the carriage and after the discharge of hydrocarbons, the presence of hydrocarbon vapour should always be suspected in enclosed spaces for the following reasons:*

- *Cargo may have leaked into compartments, including pumprooms, cofferdams, permanent ballast tanks and tanks adjacent to those that have carried cargo.*
- *Cargo residues may remain on the internal surfaces of tanks, even after cleaning and ventilation.*
- *Sludge and scale in a tank that has been declared gas free may give off further hydrocarbon vapour if disturbed or subjected to a rise in temperature.*
- *Residues may remain in cargo or ballast pipelines and pumps. The presence of gas should also be suspected in empty tanks or compartments if non-volatile cargoes have been loaded into non-gas free tanks or if there is a common ventilation system which could allow the free passage of vapours from one tank to another.*

Toxic contaminants could be present in the space as residues from previous cargoes, such as benzene or hydrogen sulphide.

To be considered safe for entry, whether for inspection, Cold Work or Hot Work, a reading of less than 1% LFL must be obtained on suitable monitoring equipment." and;

"*Respiratory hazards from a number of sources could be present in an enclosed space. These could include one or more of the following:*
Hydrocarbon vapours, such as butane and propane (inter alia)."

At the entrance of 3P cargo oil tank there was a warning sign stating “Lack of oxygen. To be ventilated before entering”. The oxygen level measured in the tank prior to entry of 20.7% was sufficient to support life. The warning sign does not address the risk of an unsafe atmosphere associated with the carriage of oil cargo.

Under the SMS and ISGOTT Ed V Ch.10 3P cargo oil tank by itself without cargo is an enclosed space. The previous cargo in 3P cargo oil tank was crude oil followed by crude oil washing operations in the cargo tank space. Therefore the cargo tank space coupled with the likelihood of hydrocarbon vapour from previous cargo defines 3P cargo oil tank as an enclosed space.

When planning to enter 3P cargo oil tank to collect the sampler the SMS procedures for enclosed space entry should have been complied with in full. 3P cargo oil tank was identified as an enclosed space by the Chief Officer but the procedures for entering 3P cargo oil tank were not fully complied with as will be discussed in section 2.5.

2.4 Purging and Gas freeing of Cargo Tanks

From information gathered during the investigation and from the statements given by the crew members there would appear to be a serious breach of the SMS procedures and accepted industry practices. The SMS states;
1.3.11.1 Gas Freeing
Before any tank is gas freed it must first be purged below 2% by volume concentration of hydrocarbon gas. Readings are to be taken at a number of levels within the tank to confirm that the entire atmosphere is below 2% HC.

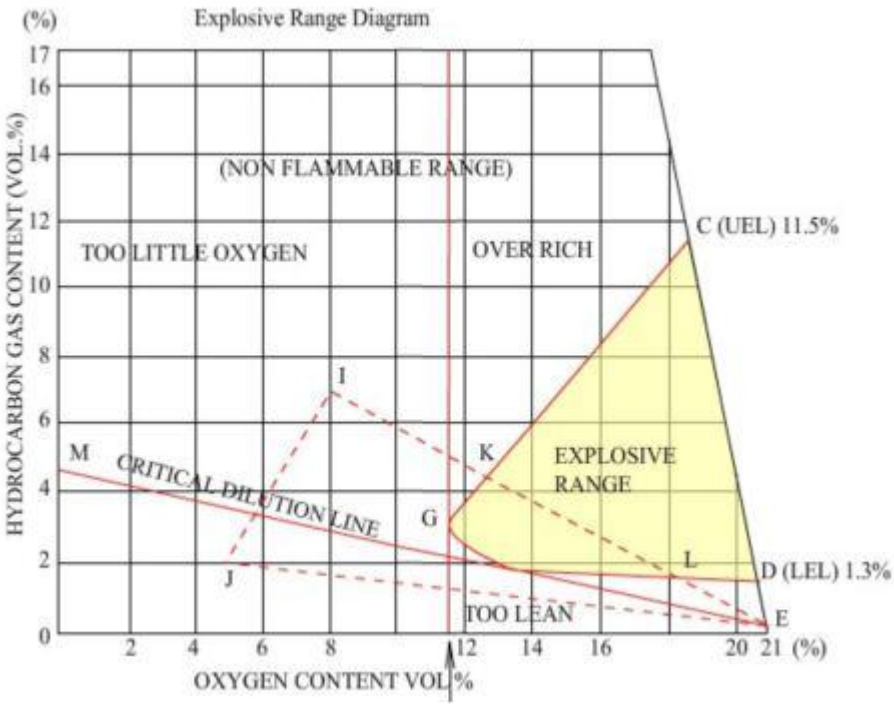
The atmosphere in a cargo oil tank after discharge consists of hydrocarbon gases and inert gas (inert gas will have oxygen content but it should be less than 5% O2). The purpose of the inert gas is to dilute the oxygen content and keep it below the percentage level that would support combustion.

To change the atmosphere into one that will allow safe entry then the O2 content must be around 20% however to reach this level then the oxygen level would pass into the explosive range and if the Hydrocarbon content was also diluted to also bring it into the explosive range then there is the danger of a catastrophic explosion should an ignition source be present.

To avoid this possibility the industry practice, and this is reflected in the operation described in the SMS, is to introduce more inert gas into the tank and drive out the hydrocarbon content (purging) to below a level that will keep it out of a flammable range (too lean) before replacing the inert gas with fresh air (gas freeing). The accepted level for the hydrocarbon content to be at prior to gas freeing is 2% or less. As well as avoiding an explosive atmosphere, the level of 1% hydrocarbon when mixed with 20% O2 will also support human life without the danger of asphyxiation from hydrocarbon gases.

To go into the gas freeing stage without first purging could have taken the tank into the explosive range but the decision to enter the tank with a HC level of 26% LEL kept the atmosphere too rich to allow an explosive condition, but also too high to support a tank entry without personnel being overcome.

While the Chief Officer had only been in the rank for three months, the Master was very experienced and there would seem to be no reason why the procedure to purge and then gas free was omitted.



There are various references within risk assessments and work permits relating to ensuring the HC level is less than 1% but no description within the Cargo Handling procedures describing the process of purging and gas freeing.

2.5 Safety Management System and Access to Enclosed Spaces

The vessel is required by Isle of Man 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, Industry Vetting Inspectors and Flag State authority.

- Last ISM External Audit by Flag:- Initial Audit – no deficiencies (approx. every 2.5 years)
- Last ISM Internal Audit by Technical Managers:- 16/7/13 no deficiencies (approx. every 12 months)
- Last Technical Inspection by Technical Managers:- 16/07/13 – no deficiencies (approx. every 6 months)
- Last Port State Control Inspection:- 07/05/13 – no deficiencies
- Last industry vetting inspection:- 09/06/13, 3 observations raised (all closed out) (approx. every 3-4 months)

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

The vessel's SMS has procedures to identify enclosed spaces on board and to ensure the safe entry into and effective rescue from enclosed spaces. See Appendix 2.

Enclosed Space
3P cargo oil tank was identified as an enclosed space – see Section 2.3.

Risk Assessment
An enclosed space risk assessment for the task of retrieving the sampler was prepared by the Chief Officer/Safety Officer in the morning of the 23rd August 2013. See appendix 3. The Chief Officer is the Ship Safety Officer as per the SMS procedures. The risk assessment prepared was based on a generic risk assessment stated in the SMS and adapted to the particular task in hand. The role of the Safety Officer is discussed in section 2.6.

A number of hazards are identified on the enclosed space entry risk assessment which includes hazards associated with atmosphere stated in 1 and 4 on the risk assessment. Prior to entry into 3P cargo all of the controls/safeguards stated on the risk assessment should have been verified. The following controls/safeguards on the enclosed space risk assessment were not put in place before entry into 3P cargo oil tank:-

1. Gas freeing – hydrocarbon was measured at 26%LEL.
2. "Men working in tanks" notice displayed - not significant in this case as crew members stood by each entrance and hatch observing.
3. Space to be water washed – water washing operations were not completed. 3P cargo oil tank was crude oil washed during cargo discharge. Only minor traces of oil residue were reported to remain in the tank. The tank was mainly reported to be clean.
4. Purged and gas free prior to entry – no purging operations were completed to remove hydrocarbon with inert gas.
5. No entry to be made unless the atmosphere is safe H2S 0ppm, LEL<1%, O2 20.9% - H2S and O2 levels measured were acceptable for entry, hydrocarbon level was not acceptable measuring greater than 1%LEL.

Atmosphere Checks
The tank atmosphere of 3P cargo oil tank was check several times before entry was made and immediately prior to entering the tank. The requirements for safe entry are:

- Oxygen is at least 20.8%. – acceptable (oxygen measured at 20.7%)
- Hydrocarbon is less than 1% LEL. – not achieved (HC measured 26%LEL)
- Hydrogen Sulphide is less than 5ppm. – achieved (measured 0ppm)
- Benzene is less than 1ppm. – not applicable in this case
- Other toxic gases that can reasonably expected to be within the space based on the risk assessment are not more than 50% of the occupational exposure limit (OEL) of any toxic vapours and gases – not applicable in this case

The vessel is equipped with the following equipment for atmosphere checks:-
x2 HC / O2 meters. The meters used on board were RIKEN RX415 and RIKEN RX517.
x3 HC / O2 / H2S meters
(x1 30meter sampling tube)
The above meters found type approved and working satisfactorily when inspected. Records on board indicate the meters are checked, cleaned, batteries renewed, tested with span gas and calibrated on a monthly basis in accordance with manufacturer's instructions.

x6 H2S personal meters
x4 HC / O2 / CO / H2S personal meters
x1 HC / O2 / HC / H2S personal meter – reported O2 detection defective in the maintenance system awaiting repairs (not used during the tank entry)
The above personal meters were found working satisfactorily (except as stated) and within expiry date when inspected.

The atmosphere of 3P cargo oil tank was measured using an HC/O2/H2S meter with the 30m sampling tube attached. The sampling tube was lowered though the aft sampling point on the main deck and the atmosphere check at 5m intervals as marked on the sampling hose. Before accepting the measurements a steady reading over 3 minutes must be obtained. The atmosphere measured at 1015 by the Chief Officer was recorded on the Enclosed Space Entry

Permit and discussed with the Master at 1020. The atmosphere was briefly checked again at 1030 prior to entry were the same results were measured as at 1015.

No additional testing of the tank atmosphere was measured through other access points to the tank. While the Chief Officer and Cadet were in the tank they were equipped with an EEBD and personal gas monitor capable of measuring HC/O2/CO/H2S.

Enclosed Space Entry Permit
An Enclosed Space Entry Permit for the task of retrieving the sampler was prepared by the Chief Officer/Safety Officer in the morning of the 23rd August 2013 in accordance with the SMS. See appendix 4. Please note that acceptable atmosphere entry conditions are stated at the end of the Enclosed Space Entry Permit for reference.

Section 1 – Pre Entry Preparations:-
All items were achieved with the exception of a "Man in Tank Notice" displayed which is not considered a significant contributory factor in this case.

Tank atmosphere measured at Oxygen 20.7%, H2S 0 % ppm, Hydrocarbon 26%LEL, CO 0%ppm.

This is the point when the job of tank entry into 3P cargo oil tank should have been stopped and re-evaluated because the hydrocarbon level measured was not less than 1%LEL. Other options should then have been considered and implemented at this point such as:-

1. Continue ventilation until hydrocarbon falls to <1%LEL; or
2. Purge the tank of hydrocarbons with inert gas and then ventilate using forced ventilation until oxygen measures 20.7% and hydrocarbon measures <1%LEL; or
3. Implement company procedure "Entry in Enclosed Spaces with Atmosphere known or suspected to be unsafe." – see below.

(none of the above options were considered or discussed by the Master or Chief Officer. During interview the Chief Officer could not identify the Enclosed Spaces Entry procedures in the company's SMS and stated the above options did not occur to him.)

Despite the tank atmosphere measurement readings and a tentative concern raised by the Chief Officer Sections 1 and 2 were signed by the Master at 1025 (for time of entry at approximately 1030) and thus tank entry was authorised to proceed by the Master.

The responsible person at the tank access hatch, the 3/O(2), was not aware of the tank atmosphere and was advised that "everything is completed and is OK". The 3/O(2) did not sight the enclosed space entry permit. Had the 3/O(2) known the tank atmosphere measurements he could have been in a position to stop tank entry proceeding.

Section 2 – Pre Entry Checks:-
This section was completed and signed by the Master and Chief Officer in the Master's cabin at 1025 before heading to 3P cargo oil tank.

"Is personnel aware of the work to be done and the conditions of the risk assessment?" The Cadet was the only other person planned to enter the tank with the Chief Officer. The Cadet was informed "oxygen is ok, be careful about not slipping over and to get out quick if there is a problem". The Cadet signed the enclosed space entry permit accepting assurance from the Chief Officer that everything was in order. The Cadet had the opportunity to read the permit but chose not to do so and signed it. Thus the risk and significance of the HC26%LEL stated on the permit was overlooked by the Cadet. It is likely the Cadet's inexperience and willingness to do as he is instructed by a senior officer prevented him from examining the permit in detail. Had the Cadet challenged the tank atmosphere measurements he could have been in a position to stop entry proceeding.

Communications will be discussed below.

Emergency rescue equipment was laid out by the tank access hatch and will be discussed below.

The Cadet and Chief Officer were both familiar with the use of EEBDs and BA sets.

Ventilation
Forced ventilation was applied to 3P cargo oil tank through the fore and aft ventilation points for two days before tank entry in preparation. The tank access hatch entrance was opened slightly to allow gas to escape. The ventilation system consisted of a 'hydrodrive' fan unit powered from the deck water. 15m trunking was hung from the fan unit. The tank is approximately 20m in height.

The ventilation system was left running continuously for two days with the tank access hatch opened slightly to allow gas to escape. During the tank entry process the ventilation was left running except when the atmosphere testing was being carried out.

Lighting
The Chief officer and Cadet each had their own torch when moving about the tank. The 3/O(2) also reflected sunlight into the tank through the tank access hatch using a large mirror.

Electrical Equipment
The Chief Officer had a portable VHF radio. The Chief Officer and Cadet each had their own torch. The portable VHF radio and torches were verified as being intrinsically safe for tank entry.

Inert Gas System
The inert gas system was verified as not operating and blanked as part of the enclosed space entry permit risk assessment.

Gas Detection
The Chief Officer and the Cadet each wore a personal gas monitor. The gas monitors performed their role adequately by alarming when measuring high hydrocarbon levels when the Chief Officer and Cadet reached the tank bottom. The alarm and dizzy feeling experienced were the first indications the tank atmosphere was unsafe. This prompted the need for immediate donning of the EEBD and evacuation of the tank.

Rescue Equipment
All equipment specified with the exception of the lifting device was made ready at the tank access hatch.

The vessel has a tripod lifting device for rescue operations but this was neglected to be placed by the tank access hatch.

Communications
Only the Chief Officer wore a VHF radio when entering the tank. At the tank access hatch the 3/O(2) had a portable VHF radio in contact with the bridge. As the tank entry was expected to last less than 10 minutes to retrieve the sampler the Chief Officer instructed the 3/O(2) not to contact him.

When the Cadet appeared to be in difficulty the 3/O(2) radioed the bridge who then sounded the general alarm. The communications between the tank access hatch and the bridge were very quick and effective.

Entry in Enclosed Spaces with Atmosphere known or suspected to be unsafe.

The procedure stated in the SMS is consistent with ISGOTT Ed V Ch 10 and COSWP Ch 17. The hydrocarbon level measured at 26%LEL strongly indicates the atmosphere to be unsafe. The sampler could have retrieved under such atmospheric conditions subject to the requirements of the procedure being fulfilled. Personnel entering the space would then wear positive pressure BA sets. The vessel has an adequate number of BA sets with crew members trained to use them on board and means to recharge empty BA bottles.

This procedure was not considered or discussed by the Master or Chief Officer. Even without implementing this procedure on board the use of BA sets to enter the tank was not considered at all. COSWP Ch 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. The Chief Officer and Master who planned the tank entry should have known and applied the SMS requirements for safe entry into an enclosed space. The dangers posed by the atmosphere measured in the tank was not appreciated and significantly underestimated by the Chief Officer who planned the tank entry and the Master who authorised entry in such conditions. Had the SMS procedures been applied properly then it is likely the sampler could have been retrieved without incident.

The Master who, ignoring advice not to enter, impulsively entered the space in an attempt to aid the Cadet also should have had the knowledge and discipline not to attempt an enclosed space rescue without wearing a BA set. This is stated in the SMS, COSWP and ISGOTT.

2.5 The Rescue Operation

The SMS has procedures for rescue from an enclosed space. See appendix 5.

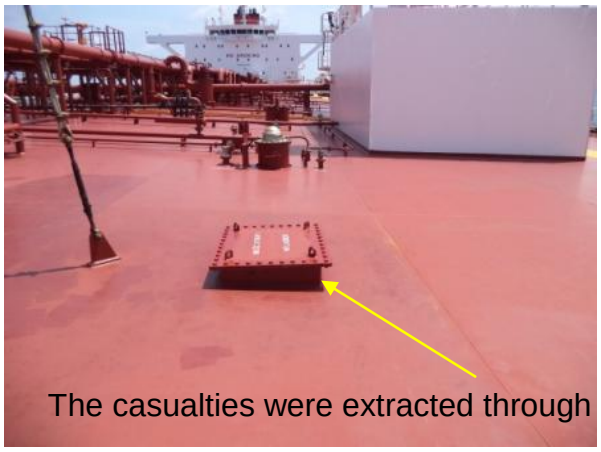
The rescue operation consisted of two components:-

1. Initial rescue of the Cadet
2. Rescue of the Cadet and the Master.

When the Cadet was first observed to be in difficulty by the 3/O(2) and the Master the initial alarm was raised quickly and effectively by VHF radio to the bridge. The general alarm was raised followed by an announcement on the public address for all crew members to proceed to 3P tank access hatch for an enclosed space rescue operation.

It was at this point the Master attempted to aid the Cadet disregarding the SMS requirement "*On no account should the person(s) attempt to enter it before additional help has arrived, and no one should enter any space or attempt to rescue, without wearing a breathing apparatus set*." **When the Master collapsed on the tank bottom there then became two casualties to rescue.**

The crew arrived quickly bringing many additional items required for the rescue. The Chief Engineer took charge of the rescue and helped organise the rescue team consisting of the 2nd Engineer and two ABs. An additional Neil Robertson stretcher had to be quickly retrieved from a storeroom when it was realised there was an additional casualty to rescue.



The vessel was equipped with adequate medical oxygen for the resuscitators in accordance with the Medical Stores Regulations[2] applicable to the type of ship. All of the medical oxygen was exhausted on board whilst giving first aid and medical treatment to the Cadet and Master.

Hoisting equipment was not used during the rescue as it had not been placed at the tank access hatch during the preparations. The casualties were raised from the tank bottom in a Neil Robertson stretcher attached to gantline with all available crew on the main deck heaving on the gantline. The same gantline was used to raise both casualties without problems. It should be noted that the gantline was rubbing against the lip of that tank access hatch during heaving. Potentially if the gantline had parted the casualty would have fallen in the stretcher to the tank bottom causing significant additional injury. Use of the lifting hoist would have made the lift easier but in this case the casualties were raised to the main deck without additional delay.

Adequate medical advice was received through the Australian Maritime Safety Authority (AMSA).
The rescue of the Master and Cadet was executed quickly and effectively with many crew members showing initiative under difficult circumstances for which they should be praised.

The ship's crew are well practiced in enclosed space rescue drills. This was evident in the crew's response in hearing the public address announcement following the general alarm. Enclosed space rescue drills are carried out monthly on board in different parts of the vessel with a report written for each drill. No problems with the rescue technique or equipment were detailed in the reports.

With the exception of the Master entering the enclosed space in contravention of the SMS procedures, COSWP 10.5 and ISGOTT 10.6, the rescue operation was conducted as per the COSWP 10.5 and 10.6.

2.6 The Role of the Safety Officer

The vessel is required to have a Safety Officer as required by Merchant Shipping Safety Official, General Duties and Protective Equipment Regulations SD816/01. The experience required to be a Safety Officer and the Safety Officer's responsibilities are stated in SD816/01 regulation 6. There is no formal certificate of qualification required for a Safety Officer.

The Chief Officer is appointed as the Safety Officer on board. Records indicate that the Chief Officer and the Master have both completed a safety officer training course in accordance with

[2] Merchant Shipping (Medical Stores) Regulations 2001 SD735/01

the requirements of STCW A-II/2 and STCW A-III/3. The requirements for demonstrating competence in Tables A-II/2 and A-III/3 do not address the Safety Officer requirements stated in Isle of Man legislation nor Code of Safe Working Practices.

The Chief Officer was able to describe his responsibilities as Safety Officer (part of the Chief Officer's job description) as stated in the safety management system:

"*The Chief Officer is the Ship's Safety Officer and he must make regular inspections of all spaces in the ship to ascertain that no safety hazards exist in accordance with the provisions of [procedure], results are formally recorded using [form]. He is responsible for the sounding of cofferdams, void spaces, fresh water and ballast tanks. He is also responsible to the Master for ensuring that:*
(i.) the maintenance of all safety, fire-fighting, LSA and antipollution equipment on board is carried out.
The proper forms must be filled in and forwarded to the Company
(ii.) the maintenance of all cargo gear is carried out
(iii.) all accidents and dangerous occurrences are reported and investigated and, where appropriate,
preventive action recommended
(iv.) there is adequate provision for the well being of ship's personnel"

The Safety Officer's responsibilities stated in the safety management system do not fully meet the responsibilities stated in SD816/01 regulation 6 or Code of Safe Working Practices Chapter 3. Only the safety inspections and accident investigation fulfil part of the Safety Officer responsibilities.

In SD816/01 regulation 6 some of the responsibilities of the Safety Officer are;
"use his best endeavours to ensure that the provisions of the Code of Safe Working Practices and the employer's occupational health and safety policies are complied with, to improve the standard of safety consciousness among the crew,"; and

"stop any work which he reasonably believes may cause an accident, and immediately to inform the master who shall be responsible for deciding when work can safely be resumed"

During interview the Chief Officer was not able to demonstrate knowledge of his responsibilities as Safety Officer in accordance with the requirements of SD816/01 Regulation 6 or Code of Safe Working Practices Chapter 3.
Under the SMS procedures (assessment of risk) for enclosed space entry (see appendix 2) the Safety Officer is responsible for;
"*determining whether enclosed spaces are suitable for entry or work inside. He shall ensure that all potential hazards are identified, the atmosphere is tested and found safe, the entry permit is issued and the appropriate safety precautions are taken*."

The Chief Officer/Safety Officer was responsible for planning the tank entry into 3P cargo oil tank who should have applied the SMS procedures in full. The atmosphere was tested and found **unsafe** in accordance with the requirements for safe entry. The Chief Officer/Safety Officer tentatively raised a concern about the tank atmosphere to the Master but was quickly and easily reassured by the Master who allowed the job to carry on if an EEBD is available for use in the tank and without reference to the SMS procedures on board.

When the Chief Officer raised his slight concern over the tank atmosphere the Master and Chief Officer/Safety Officer should have referred to and applied the SMS procedures to further convince themselves it was safe to proceed rather than relying on speculation that the HC26%LEL "will be ok". The Chief Officer's inexperience in the role and respect for the Master

meant he did not feel confident enough to challenge the Master. Where important disagreements arise regarding matters of safety they can also be referred to the Safety Committee on board before continuing. Amongst the duties of the Safety Committee are (inter alia);

- ensure the observance of the employer's occupational health and safety policies and to make recommendations for their improvement; and
- consider and take any appropriate action in respect of any occupational health and safety matters affecting the ship and its crew.

The parameters stated in the SMS procedures for atmospheric conditions for safe tank entry were then disregarded and the procedure for “entering a space where the atmosphere is known or suspected to be unsafe” was not considered.

The decision to enter 3P cargo oil tank under such atmospheric conditions with the equipment provided needed challenging and stopping. In this case as very few people were involved in the planning and execution the opportunities to challenge and stop the entry were very limited. In this case the Work Permit and Risk Assessment were primarily planned by the Chief Officer and authorised the Master who both allowed the job to continue. No-one outside of the planning process was involved or consulted, thus no-one outside of the planning process had the opportunity to raise objections regarding the level of safety. Therefore the high risk factor was self-contained and allowed to continue unchallenged.

Nb The applicability of Regulations SD816/01 will be superseded by SD234/13 (Maritime Labour Convention) Regulation under the transitional provisions stated in Regulation SD234/13 Regulation 189.

2.7 Use of the EEBD

An Emergency Escape Breathing Device (EEBD) is a supplied air or oxygen device only used for escape from a compartment that has a hazardous atmosphere and shall be of an approved type. EEBDs shall not be used for fighting fires, entering oxygen deficient voids or tanks, or worn by fire fighters. In these events, a self-contained breathing apparatus, which is specifically suited for such applications shall be used.

IMO MSC Circular 849 specifically forbids the use of EEBDs for entering oxygen deficient voids or tanks. In this case the EEBDs were not used to enter an oxygen deficient atmosphere but to escape from high hydrocarbon gas concentrations.

The risk assessment for enclosed space entry stated “persons wear an EEBD”. Use of the word “wear” in this case meant worn over the shoulder and did not mean EEBD worn with hood over the person’s head and air activated. The risk assessment is based on compliance with the SMS procedures being fully implemented, ie. a tank atmosphere consisting of oxygen 21% HC<1%LEL and Hydrogen sulphide <2%. The intended use of carrying the EEBD in these circumstances is if there are unexpected concentrations of hydrocarbon vapour or low oxygen levels where the EEBD would be used to escape from the tank.

The Sharp Lady is provided with 15 Jiangsu Huayan Marine Equipment EEBDs each capable of approximately 15 minutes duration of average usage. The EEBD is approved to IMO Res MSC.98(73). The EEBD is a self-contained, open circuit, compressed air, constant flow EEBD. It comprises a compressed air cylinder with a combined reducer/cylinder valve, attached to a close fitting escape hood by a breathing hose. The whole unit is contained within a stowage bag ready for immediate use. The high-visibility bag is clearly marked FOR *ESCAPE ONLY*. See the following pictures;

The manufacturer's instructions state EEBDs are intended for use in atmospheres polluted by smoke, toxic gas, hot vapour or low oxygen levels while escaping to a place of safety. The 15 minute duration of the EEBD is achieved by means of a reducer/cylinder valve which restricts the flow of air from the cylinder to the mask, so that once activated a steady flow of air is provided to the wearer. It is not a demand valve system. It is likely that as the Cadet lay unconscious on the tank bottom the constant flow of air from the EEBD reduced the damaging effects from the toxic gas.

Records on board indicate the EEBDs are subject to monthly inspection on board and are sent ashore annually for servicing. No evidence was found that there was any technical fault with any of the EEBDs on board. The ship has the capability to recharging any EEBDs used on board. Additional sets were specifically provided for training purposes only.

In this case the EEBD was not used in accordance with the SMS procedures on board since it was known that there were high levels of hydrocarbon gas in the tank.

Conclusions

The Master died, the Cadet seriously injured and the Chief Officer slightly injured as a result of making an authorised entry into an enclosed space with an unsafe atmosphere.

Not following industry practice and Company procedures with regard to purging and gas freeing the cargo tank and to only enter after prescribed HC and O2 levels were reached was the main factor in the atmosphere being unsafe.

3P cargo oil tank was identified as an enclosed space in accordance with the SMS, COSWP and ISGOTT. Not all safeguards stated on the enclosed space risk assessment were implemented.

The atmospheric conditions of the tank measured did not fall within the atmosphere parameters stated within the SMS, COSWP and ISGOTT for safe tank entry. The HC level measured was greater than 1%LEL.

The enclosed space entry work permit should not have been authorised by the Master and the tank entry preparations re-evaluated against the SMS procedures and other options for safe entry considered by the Master and Chief Officer. The Chief Officer should have challenged the Master's decision to proceed with the tank entry.

Not all crew members entering the tank and controlling access to the tank were aware of the unsafe atmosphere within the tank space. Had the crew members involved known the HC level and verified the level against the specified parameters they would have been in a position to challenge the entry. If a disagreement persisted a safety committee could have convened to resolve the issue.

This incident needed just one person to stand up and say "NO!" However, the cultural nature of the crew was to accept the decision of someone senior in the hierarchy on board.

With the exception of the Master's attempt to aid the Cadet, the rescue operation was quickly and effectively executed for the crew should be praised. Despite no hoisting equipment being used the casualties were extracted from the tank space without incident or delay.

The duties of the Safety Officer as prescribed by Isle of Man legislation are not fully incorporated into the SMS. The duties of the Safety Officer as per Isle of Man legislation and COSWP were not fully known by the Chief Officer/Safety Officer. The tank entry could have been stopped under the legal power of the Safety Officer.

The EEBDs should not have been used for the tank entry in an unsafe atmosphere as the safeguards stated on risk assessment were not fully implemented.

Despite the numerous information and procedures on ships concerning the dangers of enclosed spaces and actions on finding a person in an enclosed space, the training ashore, the training on board ship, frequent enclosed space rescue drills and numerous reports circulated amongst ships concerning deaths related to enclosed space entry and attempted rescues it is very sad and disappointing that such an event could have occurred. It is difficult to predict how different people respond in real emergency situations no matter how well trained and experienced they are under normal circumstances. The Master's decision to authorise the tank entry without appropriate safeguards knowing the atmosphere is unsafe and his impulsive, possibly instinctive reaction to aid the Cadet (no matter how well intentioned) goes against all training, procedures and information provided on board and should serve as another valuable lesson to all seafarers of what not to do.

Recommendations
The Isle of Man Ship Registry is recommended to:-

Distribute this report to Masters and Technical Managers concerned with Isle of Man ships to further emphasize the dangers associated with enclosed spaces and to highlight the importance of effective enclosed space familiarisation and entry procedures.

Forward a copy of this report to the Issuing Authority of the Chief Officer's Certificate of Competency.

Scinicariello Ship Management is recommended to:-

Promote the power of the Safety Officer, Safety Representatives and empower other concerned crew members on managed vessels to stop any work which they reasonably believe may cause an accident.

Review the Cargo Handling Procedures in the SMS to provide instructions on and detail the reason for purging and gas freeing of cargo tanks and to provide more guidance in this section on this cycle of operation.

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

Ensure all persons entering an enclosed positively identify the atmosphere condition against the atmospheric parameters stated in the SMS for safe entry and provide appropriate conditions where crew members can challenge the tank entry preparations and equipment to be used without fear of victimisation.

Review the position, responsibilities and training of the Safety Officer in Safety Management System in accordance with the requirements of SD234/13 Regulation 104 and Code of Safe Working Practices Chapter 3.

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

Appendix 1

Oil Cargo Sampling Device

The complete oil sampler device

The oil sampler bucket

Note – this is not the oil sampler that broke in Geelong on the 09th August 2013.

Appendix 2
Selected sections of the Company SMS regarding Enclosed Spaces.

Enclosed Spaces Entry Procedures
To ensure that, on each occasion, when it is necessary to enter an enclosed space for inspection or to carry out any work, the space is safe for entry and the correct precautions are being followed, an Enclosed Space Entry Permit System shall be utilised. Masters should be aware that port and terminal requirements or national legislation for enclosed space entry may differ from the contents of this procedure. Where differences exist between this procedure and any legislative authority the highest standard shall always be followed.
(Refer also to the Code of Safe Working Practices for Merchant Seamen - Chapt. 17 and ISGOT Ed.V - Chapt. 10)

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 where are identified all the enclosed spaces

Note: Although pump rooms come within the above definition of an enclosed space, they have their own particular equipment, characteristics and risks. These require special precautions which are addressed in a separate procedure.

Assessment of Risk
In order to ensure the safety of all personnel involved in an enclosed space entry, a thorough risk assessment is to be carried out to determine all foreseeable hazards associated with the entry.

The Safety Officer is responsible for determining whether enclosed spaces are suitable for entry or work inside. He shall ensure that all potential hazards are identified, the atmosphere is tested and found safe, the entry permit is issued and the appropriate safety precautions are taken.

This procedure contains the primary safeguards associated with enclosed space entry. However under certain circumstances additional safeguards may be required, as identified by the risk assessment, to ensure that all risks are reduced to "As Low as Reasonably Practicable."
Such additional safeguards as identified must be entered under the section "Special conditions I precautions necessary" on the enclosed space entry permit.
When assessing risk, the following should be amongst those items taken into account:

- Nature and construction of the enclosed space.
- Nature of work to be done in the space.
- Consideration of all on-going vessel operations, including movement etc.
- Competence and experience of persons involved in the entry.
- Any foreseen difficulties or limitations with access to any part of the space.
- Over familiarity with a space when repetitive entries are to be made

Atmosphere Checks
Any decision to enter an enclosed space should only be taken after the atmosphere within the space has been comprehensively tested from outside the space with test equipment that is of an approved type and that has a valid calibration certificate and has been checked for correct operation before use.

Prior to testing the atmosphere within the space for Oxygen, Hydrocarbons or Toxic Gases, the ventilation shall be stopped **for a period of at least 10 minutes**, in order to obtain a representative sample of the space atmosphere rather than the recently introduced fresh air. Atmosphere checks should be carried out at upper, middle and lower levels in order to obtain readings from a representative cross-section of the space in question.

Requirements for safe entry are:

- Oxygen is at least 20.8%.
- Hydrocarbon is less than 1% LEL.
- Hydrogen Sulphide is less than 5ppm.
- Benzene is less than 1ppm.
- Other toxic gases that can reasonably expected to be within the space based on the risk assessment are not more than 50% of the occupational exposure limit (OEL) of any toxic vapours and gases

After that initial test have been satisfactorily carried out (from main deck) and recorder, a full assessment of tank atmosphere is request. The person undertaking the test should enter the tank carrying a EEBD and personal gas monitor in addition to the gas testing instrument. During this entry the atmosphere should be checked with particular attention on testing the work location(s) and places that are inaccessible for testing from the main deck. Atmosphere checks are to be made at frequent intervals while the space is occupied and Gas readings should be entered in the appropriate place on the Enclosed Space Entry Permit.

Enclosed Space Entry Permit

A valid Enclosed Space Entry Permit shall be issued prior to any entry into an enclosed space. The following shall apply:

- The permit will become invalid if the forced ventilation stops or if any of the conditions noted on the pre-entry check list change.
- A new permit is required if the space has been left before job completed.
- Entry permits are to be completed by hand on each occasion. Computer generated permits, other than blank forms, are not permitted in any circumstances.
- A copy of the permit shall be prominently displayed at the entrance to the space to inform personnel of the precautions to be taken when entering and of any restrictions placed upon the activities permitted within the space.
- Completed risk assessments shall be filed with the permit as applicable and retained on board for a period of three years.

If the space has been left before job completed, it is compulsory prior to reentry the space to recheck the space atmosphere and issue a new " Entry Permit".

Ventilation

Adequate forced ventilation shall be maintained at all times. In the event of any failure of the ventilation system the space shall be vacated immediately.

Lighting

There shall be adequate lighting arrangements inside an enclosed space, either with approved hand lamps, or intrinsically safe floodlights.

Electrical Equipment

Unless the space is approved for hot work and the relevant permit issued, only approved intrinsically safe electrical equipment may be used inside.

Inert Gas System

If any work or inspection is being carried out inside a space connected to the IG System then the IG line to that space must be physically blanked or spaded. Closing only the IG line valve to the space is insufficient as a safeguard. A procedure must be established to ensure that the space

cannot be reconnected up to the IG system before all work in the space is completed. If work is carried out inside a tank a water bottom is required to prevent any possibility of gas leakage through the bottom lines, either in the tank that is gas free, or from other tanks on the same line.

Gas Detection
At least one person in each group of workers entering the enclosed space must be equipped with a multi gas personal monitor.

Rescue Equipment
Appropriate rescue equipment is to be made ready at the entrance to the space. This shall include:
• Two positive pressure SCBA sets, with spare cylinders.
• Resuscitator.
• Tank Rescue or lifting device as appropriate.
• Life line, rescue harness and stretcher.
• Additional intrinsically safe torches or hand lamps.
• Gas detection equipment to ensure immediate availability in the event a rescue is required.
• Portable Radios.

During the initial risk assessment and briefing details of a rescue plan shall be discussed in order that all persons involved are aware of their duties in the event of an emergency.

Communications
Communications shall be established between the personnel inside the space, the deck watchman and whenever practical, the OOW on the bridge. A crewmember who is aware of the procedure to be followed by the persons inside the space, expected length of time inside and the procedure for raising the alarm in the event of an emergency shall be delegated as “watchman”. The watchman shall contact the persons inside the space at regular intervals, as indicated on the entry permit, to ensure that all is satisfactory. This is particularly important when the work is being carried out outside the line of sight of the watchman

Man in the Enclosed Space Notice
Whenever work is being carried out inside an enclosed space, then a suitable notice shall be displayed at the point of entry indicating that personnel are working inside. This notice shall remain in place until work is finally completed and the tank is ready for securing. A proper record of all personnel entering and leaving the space must be maintained in an appropriate logbook.

Entry Into Enclosed Spaces with Atmosphere known or suspected to be Unsafe
Unless in case of absolute emergency or to carry out a rescue any entry into enclosed spaces with atmosphere known or suspected to be unsafe shall only be considered where no practical alternative exists**.**
In the event of such an entry being deemed necessary the following shall apply:

- A written statement shall be issued by the Master stating that there is no practicable alternative to the proposed method of entry and that such entry is essential for the safe operations of the ship.
- A full risk assessment is to be carried out completed on board and attached to a written request for Entry Permission submitted to the Company.
- The Company Safety Manager, his appointed deputy or Operations Manager is responsible for authorization of any such entry.
- A responsible officer shall supervise the operation and ensure that:
- Any persons entering the space are fitted with and properly trained in the use of positive pressure breathing apparatus, multi-gas detectors, appropriate protective clothing, and are connected to a lifeline.
- The number of persons entering the space is kept to an absolute minimum consistent with the work to be carried out.

- Ventilation is provided where possible.
- A means of continuous communication is established and a system of signals is agreed by the persons involved.
- Spare sets of breathing apparatus, a resuscitator and rescue equipment are available at the entrance to the space.
- A standby team, with breathing apparatus donned shall be ready in case of emergency.
- It is essential that any work undertaken is carried out in a manner that shall avoid creating an ignition hazard.

Appendix 3
Risk Assessment

SCINICARIELLO
SHIP MANAGEMENT S.p.A.

RISK ASSESSMENT

VESSEL NAME	SHARP LADY	Risk Ass.REF. No.	RD 008 / 13	DATE	23/08/2013	DUE DATE	23/08/2013
WORK ACTIVITY	ENCLOSED SPACE ENTRY	Rutine Activity		Non Rutine Activity	X		
Assessors:	MASTER , CHIEF OFFICER	Department	DECK				

Note 1 : For routine activities, once assessed the risk it will be reviewed every six (6) months,after a incidendt or as needed.
Note 2: For non routine activities, new risk assessment must be done every time
Note 3 : In case of loss control while performing any operation refer to SMS Manual 3 Chapt. 2

No.	Hazard Associated with activity	Possible consequences	Severity	Likelihood	Risk Level	Control/Safeguards put in place to reduce risk	Residual Severity	Residual Likelihood	Residual Risk Level	Additional control Rq'd Y/N
1	LACK OF OXYGEN, PRESENCE OF HYDROCARBONS AND TOXIC GASES	DANGEROUS FOR PERSONS.	EXTREMLY HARMFUL	HIGHLY UNLIKELY	3	PERMIT TO WORK FOR ENCLOSED SPACE USED. GAS FREE SPACE BEFORE ENTRY. THOROUGH GAS CHECK BY CH OFF.VENTILATION TO BE MAINTAINED THROUGH OUT THE TIME. PERSONS WEAR E.E.B.D AND PERSONAL GAS MONITER. RESCUE	HARMFUL	HIGHLY UNLIKELY	2	N
						EQUIPMENT TO BE KEPT STANDBY ON THE ENTRANCE. ONE PERSON IS KEPT STANDBY WITH RADIO AS A LINK MAN BETWEEN ENTRYTEAM AND BRIDGE. LOCK I.G VALVE SHUT / BLANKED.				
2	FALLING OBJECTS.	PERSONAL INJURY	HARMFUL	HIGHLY UNLIKELY	2	ALWAYS CORRECT P.P.E ARE USED. NO TOOL TO BE CARRIED IN POCKET, TOOLS TO BE CARRIED IN A TOOL BOX OR BUCKET.	SLIGHTLY HARMFUL	HIGHLY UNLIKELY	1	N

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SCINICARIELLO
SHIP MANAGEMENT S.p.A.

RISK ASSESSMENT

VESSEL NAME	SHARP LADY	Risk Ass.REF. No.	RD 008 / 13	DATE	23/08/2013	DUE DATE	23/08/2013
WORK ACTIVITY	ENCLOSED SPACE ENTRY	Rutine Activity		Non Rutine Activity	X		
Assessors:	MASTER , CHIEF OFFICER	Department	DECK				

Note 1 : For routine activities, once assessed the risk it will be reviewed every six (6) months,after a incidendt or as needed.
Note 2: For non routine activities, new risk assessment must be done every time
Note 3 : In case of loss control while performing any operation refer to SMS Manual 3 Chapt. 2

3	TANK HATCH BEING SHUT.	DANGEROUS FOR PERSONS.	EXTREMLY HARMFUL	HIGHLY UNLIKELY	3	ONE PERSON SHOULD STAND BY AT THE ENTRANCE, AND NOTICE TO BE POSTED"MEN ARE WORKING IN TANKS" AT TANK ENTRANCE.	HARMFUL	HIGHLY UNLIKELY	2	N
4	EXPLOSION HAZARD DUE TO TOXIC GASES.	PERSONAL INJURY / DAMAGE TO SHIP.	EXTREMLY HARMFUL	HIGHLY UNLIKELY	3	SPACE TO BE WATER WASHED, PURGED AND GAS FREE PRIOR TO ENTRY. NO ENTRY MADE UNLESS THE ATMOSPHERE IS SAFE H2S 0 PPM, LEL LESS THAN 1%, O2 20.9%.	HARMFUL	HIGHLY UNLIKELY	2	N
5	SLIPS AND FALLS.	PERSONAL INJURY.	SLIGHTLY HARMFUL	UNLIKELY	2	CREW SHOULD AWARE OF POSSIBILITY OF MUD, SLUDGE AND OIL IN THE TANK. CORRECT FOOT WEAR TO BE WORN. FACE STAIRWAYS WHEN GOING DOWN AND USE BOTH HANDS	SLIGHTLY HARMFUL	HIGHLY UNLIKELY	1	N

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SHIP MANAGEMENT S.p.A.

RISK ASSESSMENT

VESSEL NAME: SHARP LADY

Risk Ass.REF. No.: RD 008 / 13

DATE: 23/08/2013

DUE DATE: 23/08/2013

WORK ACTIVITY: ENCLOSED SPACE ENTRY

Rutine Activity: [ ]

Non Rutine Activity: X

Assessors: MASTER , CHIEF OFFICER

Department: DECK

Note 1 : For routine activities, once assessed the risk it will be reviewed every six (6) months,after a incidendt or as needed.
Note 2: For non routine activities, new risk assessment must be done every time
Note 3 : In case of loss control while performing any operation refer to SMS Manual 3 Chapt. 2

No.	Hazard Associated with activity	Possible consequences	Severity	Likielihood	Risk Level	Control/Safeguards put in place to reduce risk	Residual Severity	Residual Likelihood	Residual Risk Level	Additional control Rq'd Y/N
6	FALLING DOWN	PERSONAL INJURY.	HARMFUL	UNLIKELY	3	ALL OPENINGS TO BE ROPED OFF OR GRATING PLACED OVER MANHOLES, WARNING NOTICED POSTED	SLIGHTLY HARMFUL	UNLIKELY	2	N
7	LEAKS FROM PIPES AND VALVES.	SPPLIAGE	SLIGHTLY HARMFUL	UNLIKELY	2	ALL LINES TO BE WASHED AND DRAINED. WARNING NOTICE IS POSTED IN CCR. ALL LINES ARE ISOLATED.	SLIGHTLY HARMFUL	HIGHLY UNLIKELY	1	N
8	DARKNESS	PERSONAL INJURY.	SLIGHTLY HARMFUL	UNLIKELY	2	PROPER LIGHTINING / PROPER TORCHES PROVIDED.	SLIGHTLY HARMFUL	HIGHLY UNLIKELY	1	N

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RISK ASSESSMENT

Additional Control Measures

Hazard No	Further action if necessary (Additional Controls)	Responsible	Remedial action due	Date Completed

Additional Comments:

Signed [redacted] Chief Officer/~~Chief Engineer~~

[redacted] Master

23/08/2013 Date

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RISK ASSESSMENT

Table 1 Measures of Likelihood

Level	Descriptor	Exemple detailed description
1	Likely	Will occur several times in the life
2	Unlikely	Will occur at some time in life
3	Higly Unlikely	So unlikely that it can be assumed its occurrence may not be experienced

Table 2 Measures of Severity

Level	Descriptor	Exemple detailed description
1	Slightly Harmful	First aid treatment, on-site release pollutantis immediately contained,minor financial and reputation loss
2	Harmful	Medical treatment required,off-site pollutant release causing moderate environmental damage ,moderate financial and reputation loss
3	Extremely Harmful	Fatality or extensive injuries (e.g. permanent disability), off-site pollutant release causing major or severe environmental damage, major or huge financial and reputation loss

Severity Hazards Matrix

Severity / *Likelihood*	Slightly Harmful	Harmful	Extremely Harmful
Likely	Moderate Risk 3	Substantial Risk 4	Intolerable Risk 5
Unlikely	Tolerable Risk 2	Moderate Risk 3	Substantial Risk 4
Highly Unlikely	Minimal Risk 1	Tolerable Risk 2	Moderate Risk 3

(a) Select the expression for Likelihood which most applies to the hazard. (1st column)
(b) Select the expression for severity which most applies to the hazard. (1st row)
(c) Cross reference using the above table to determine the level of risk. e.g the likelihood = unlikely, and severity = harmful, then risk level is 3
(d) If risk level is 3 or above then additional controls are required

The table below indicates the recommended response in each case

RISK 1 - Minimal	No action is required
RISK 2 - Tolerable	No additional controls are required. Monitoring is required to ensure control is maintained.
RISK 3 - Moderate	Effort are required to reduce risk.. Controls are to be implemented within a specific time.
RISK 4 - Substantial	New work not to start until risk reduced. If work in progress, urgent action to be taken. Resurces may be required
RISK 5 - Intolerable	Work shall not be started or continued until the risk has been reduced. If reduction is not possible, the activity shall be prohibited.
NOTE N° 1	For routine activities, once assessed the risk will be reviewed every six (6) months or as needed.
NOTE N° 2	for non-routine activities,new risk assessment must be done every time.

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Appendix 4
Enclosed Space Entry Permit

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ENCLOSED SPACE ENTRY PERMIT

This Permit shall be used for all Enclosed Space Entries and may be valid for a maximum of 12 hrs.
A separate permit is required for each Enclosed Space Entry.
Atmosphere tests have to be made after any interruption or break in the work and a new Entry Permit is required.
If Hot Work is to be carried out within the space then a separate Hot Work Permit must be issued.
This permit will become invalid in case of ventilation stoppage/failure or if a change of conditions occurs.

Vessel: M.T SHARP LADY **Date** 23/08/2013 **Ref No.:** D-28/13

Location/Name of Space: 3P CARGO OIL TANK **Reason for Entry:** TO REMOVE THE SAMPLER

This permit is valid From 1030 hrs Date 23/8/13
To 1300 hrs Date 23/8/13

Copy of this permit has to be posted in the entrance of enclosed space

Section 1 - PRE-ENTRY PREPARATIONS
(To be checked by the Master or Safety Officer)

- ☐ Has a Formal Risk Assessment been carried out and documented? (Ref.N° RD - 08) — Y
- ☐ Has been considered weather impact on works that is going to be performed? — Y
- ☐ Has the space been properly segregated by blanking off all connecting pipelines ? — Y
- ☐ Have valves on all pipelines serving the space been secured to prevent their accidental — Y
- ☐ Have necessary initial Atmosphere checks been carried out and documented? — Y
- ☐ Has the space been cleaned ? EMPTY — Y
- ☐ Has the space been thoroughly ventilated ? — Y
- ☐ Have arrangements been made for frequent atmosphere checks to be carried out? If Yes enter time — N
- ☐ Have arrangements been made to ensure the space is continuously ventilated? — N
- ☐ Is adequate illumination provided ? — Y
- ☐ Is rescue and resuscitation equipment available for immediate use by the entrance to the — Y
- ☐ Has a responsible person been designated to stand by at the entrance? (Name /Rank [redacted] 3/O) — Y
- ☐ Has the OOW (bridge, Eng. Room, CCR) been advised of the planned entry ? — Y
- ☐ Has a system of communication been established and properly tested? — Y
- ☐ Are emergency and evacuation procedures established and understood ? — Y
- ☐ Is there a system for recording who is in the space ? — Y
- ☐ Is the Man in Tank Notice ready to be displayed at the entrance to the space? — Y
- ☐ Is Gas Detection Equipment available at the entrance to the space? — Y
- ☐ Is personnel entering the space properly equipped and clothed? (see PPE Matrix - SMS Man.1 — Y
- ☐ Is all equipment used of an approved type and in good conditions? — Y
- ☐ Is pre-entry atmosphere tests carried out? — Y

Oxygen: 20.7 % (Vol) Time 1015 H2S: 0 % (PPM) Time 1015
Hydrocarbon: 0.0 % (LEL) Time 1015 CO: 0 % (PPM) Time 1015
Benzene: - % (PPM) Time - Other: - % (PPM) Time -

Instrument(s) Used: RIKEN KEIKI MULTI GAS RX517 Calibrated: 23/8/13

Master/Safety Officer name: [redacted] Signature: [redacted] Date/time: 23/8/13 1030

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Section 2 - PRE-ENTRY CHECKS
(To be checked by the person authorised as leader of the team entering the space)

	Y	N
☐ Section 1 of this permit has been fully completed.	Y	
☐ Is personnel aware of the work to be done and the conditions of the Risk Assessment?	Y	
☐ Is personnel aware that the space must be vacated immediately in the event of ventilation failure or any change in conditions?	Y	
☐ Is personnel agreed with communication procedures?	Y	
☐ Is personnel agreed with a reporting interval [<10] minutes	Y	
☐ Emergency and evacuation procedures have been agreed and are understood.	Y	
☐ Is involved personnel familiar with the proper use of BA and EEBD?	Y	

Special conditions and precautions necessary (as per Risk Assessment):

IN CASE OF ANY ALARM ON PERSONAL GAS MONITOR OR IN CASE OF COMMUNICATION FAILURE LEAVE THE SPACE IMMEDIATLY

Following personnel has been authorized to enter the space and they agree:

NAME	RANK	SIGNATURE
[redacted]	CH. OFF	[redacted]
	CADET	

In the circumstances noted it is considered safe to proceed with the Enclosed Space Entry:

Leader of team entering the space Name: [redacted] **Signature** [redacted] **Date/time:** 23/8/13 @ 1025

Master has verified/ approved sections 1 and 2 Name [redacted] **Signature:** [redacted] **Date/time:** 23/8/13 @ 1025

Record of Gas Tests taken during rechecking of enclosed space atmosphere by responsible Officer

Oxygen:	% (Vol)	Time	H2S:	% (PPM)	Time		
Hydrocarbon	% (LEL)	Time	CO:	% (PPM)	Time		
Benzene:	% (PPM)	Time	Other:	% (PPM)	Time		

Instrument(s) Used: Calibrated:

Signature

Oxygen:	% (Vol)	Time	H2S:	% (PPM)	Time
Hydrocarbon	% (LEL)	Time	CO:	% (PPM)	Time
Benzene:	% (PPM)	Time	Other:	% (PPM)	Time

Instrument(s) Used: Calibrated:

Signature

Oxygen:	% (Vol)	Time	H2S:	% (PPM)	Time
Hydrocarbon	% (LEL)	Time	CO:	% (PPM)	Time
Benzene:	% (PPM)	Time	Other:	% (PPM)	Time

Instrument(s) Used: Calibrated:

Signature

ENTRY/LEAVING CHECKS
(To be checked by the responsible person designated to stand by at the entrance)

	Name	Time Entering	Intended Duration	Time Leaving		Name	Time Entering	Intended Duration	Time Leaving
1	[redacted]	1035	10	1042	11				
2	[redacted]	1035	10		12				
3	[redacted]	1040			13				
4	[redacted]	1052	20	1113	14				
5	[redacted]	1053	20	1113	15				
6	[redacted]	1053	20	1114	16				
7					17				
8					18				
9					19				
10					20				

Section 3 - PERMIT CLOSURE

Mark box as appropriate

☐ The operation has been cancelled _____ (date/time) all personnel has been left the enclosed space and all relevant parties have been notified.

☐ The operation has been completed _____ (date/time). All personnel has been left the enclosed space and all relevant parties have been notified, the materials and equipment have been withdrawn and the space has been reinstated in proper condition.

To be signed by:	Name	Signature	Date/time
Team leader			
Responsible Super. Pers			
Master/Safety Officer			

Notes:

1 The Entry Permit should contain a clear indication as to its maximum period of validity which, in any event, should not exceed
2 In order to obtain a representative cross-section of the compartment's atmosphere, samples should be taken from several depths and through as many openings as possible. Ventilation must be stopped for about 10 minutes before the
3 Tests for specific toxic contaminants, such as benzene and hydrogen sulphide, should be undertaken depending on the nature of the previous contents of the space.
4 **Acceptable Atmosphere Entry Conditions are as follows:**

O2 = 20.8 - 21%	HC - Below 1% L.E.L.	Benzene - Below 1 ppm	H2S - Below 5 ppm	CO - Below 25 ppm

DO IT SAFELY OR NOT AT ALL.

Appendix 5
Procedures for rescue from enclosed spaces

Initial alarm
A responsible member of the crew outside an enclosed space who notices something wrong within, or any other person who sees or suspects a casualty within an enclosed space should first raise an Alarm.
On no account should the person(s) attempt to enter it before additional help has arrived, and no one should enter any space or attempt to rescue, without wearing a breathing apparatus set.
The only exception to the rescuer not wearing a breathing apparatus set is when it is positively known that the cause of the accident was not a deficiency in the space atmosphere.

Mustering of rescue resources
On hearing an alarm, the Master or responsible officer should muster a Rescue Team comprising at least 2 persons and a third person in charge who should remain outside the space to exercise control. Unless not already ready at space entrance before the enclosed space entry was permitted, the following minimum items should be assembled at site:

- 2 x Self Contained Breathing Apparatus
- EEBD
- Resuscitator
- Lifelines (to be used unless impracticable)
- Rescue Harness / Neil Robertson stretcher, with rope

Rescue
The rescuers entering the enclosed space must wear a SCBA and carry an EEBD and Rescue Harness for use of casualty. They should be in continuous communication with the rescue supervisor who in turn should apprise the Master of the events. Personnel should be allocated to relieve or back-up the rescue team. Support team should arrange back up equipment outside space like spare SCBA bottles, ropes, first aid equipment, and possibly hoisting equipment to aid in lifting the casualty. A stretcher if available is necessary to evacuate any casualty with suspected neck or spinal injuries, after fastening him. In other cases, a rescue harness may be used. If necessary, the EEBD is to be used to supply the casualty with fresh air. In case the casualty requires artificial respiration, then the resuscitator must be used.

Note : “Resuscitation apparatus” provided to all Vessels, it should be always kept for immediately use, should be stowed where it is easily accessible and not kept locked up and also crew must be aware of its location and are trained in its proper use.

The casualty should be moved to the nearest safe adjacent area outside the enclosed space unless his injuries and the likely time of evacuation make some treatment essential before he is moved.

Medical advice is to be sought from shore as required.