Report on the investigation of

the fatality of a chief officer in a ballast tank

on board the container ship

Ville de Mars

in the Gulf of Oman

28 January 2009

Marine Accident Investigation Branch
Mountbatten House
Grosvenor Square
Southampton
United Kingdom
SO15 2JU

Report No 20/2009
September 2009

Extract from

The United Kingdom Merchant Shipping

(Accident Reporting and Investigation)

Regulations 2005 – Regulation 5:

"The sole objective of the investigation of an accident under the Merchant Shipping (Accident Reporting and Investigation) Regulations 2005 shall be the prevention of future accidents through the ascertainment of its causes and circumstances. It shall not be the purpose of an investigation to determine liability nor, except so far as is necessary to achieve its objective, to apportion blame."

NOTE

This report is not written with litigation in mind and, pursuant to Regulation 13(9) of the Merchant Shipping (Accident Reporting and Investigation) Regulations 2005, shall be inadmissible in any judicial proceedings whose purpose, or one of whose purposes is to attribute or apportion liability or blame.

Further printed copies can be obtained via our postal address, or alternatively by:
Email: maib@dft.gsi.gov.uk
Tel: 023 8039 5500
Fax: 023 8023 2459

All reports can also be found on our website:
www.maib.gov.uk

CONTENTS

GLOSSARY OF ABBREVIATIONS AND ACRONYMS

AB	:	Able bodied seaman
BA	:	Breathing Apparatus
BV	:	Bureau Veritas
CEC	:	Certificate of Equivalent Competency
CMA CGM	:	Compagnie Maritime d'Affretement - Compagnie Generale Maritime
COSWP	:	Code of safe working practices for merchant seamen
CPR	:	Cardio pulmonary resuscitation
DPA	:	Designated person ashore
DSC	:	Digital selective calling
EDS	:	Entry into Dangerous Spaces
EEBD	:	Emergency escape breathing device
ESG	:	Emergency situations guide
ESP	:	Enhanced survey programme
EU	:	European Union
GMDSS	:	Global maritime distress and safety system
IMO	:	International Maritime Organization
ISM	:	International Safety Management code
LNG	:	Liquid natural gas
"Mayday"	:	Internationally accepted spoken distress signal
MCA	:	Maritime and Coastguard Agency
MGN	:	Marine guidance note
MSC	:	Maritime Safety Committee

“Pan Pan”	:	Internationally accepted spoken urgency signal
RCC	:	Rescue co-ordination centre
SMS	:	Safety Management System
SOLAS	:	International Convention for the Safety of Life at Sea
SSE	:	Safety security environment
TEU	:	Twenty-Foot Equivalent Unit
UAE	:	United Arab Emirates
UKMTO	:	United Kingdom Maritime Trade Organisation
UTC	:	Universal Co-ordinated Time
UHF	:	Ultra high frequency
VHF	:	Very high frequency
WBT 1F	:	Water ballast tank No 1 forward

Times: All times used in this report are UTC+4 unless otherwise stated

SYNOPSIS

On 28 January 2009, the chief officer on board the UK registered container ship *Ville de Mars* fell almost 8m when descending into a water ballast tank. The vessel was on passage in the Gulf of Oman. He was removed from the tank by the ship's crew and died while being flown to a hospital ashore in Oman by a Royal Navy helicopter. The chief officer had been due to leave the vessel the following day in Jebel Ali, UAE. No postmortem was conducted.

The chief officer was not wearing a fall arrestor as he entered the ballast tank, and it is almost certain he slipped and fell from an un-guarded stringer. The precautions taken in preparation for his entry into the tank did not comply with the requirements of company procedures or industry practice. No permits to enter into an enclosed space or to work at height were issued. Although non compliance with the permit to work system had previously been identified during a company internal audit, no effective remedial action had been taken.

This is one of an increasing number of accidents which have resulted from complacency. Preventing this kind of behaviour at sea, where ship owners and managers are frequently thousands of miles from their vessels, is a huge challenge.

A recommendation has been made to CMA CGM Group aimed at identifying ways of combating complacency and instilling a positive safety culture on board its ships. It also aims to ensure that the methods identified are shared with the industry via the MCA's Human Element Advisory Group. A further recommendation has been made to CMA CGM Group aimed at improving the effectiveness of its internal vessel audit regime.

Ville de Mars

SECTION 1 - FACTUAL INFORMATION

1.1 PARTICULARS OF *VILLE DE MARS* AND ACCIDENT

Vessel details

Registered owner	:	CMA CGM SA Marseille, France
Managing owner	:	CMA CGM SA Marseille, France
Time Charterer	:	CMA CGM SA Marseille, France
Crew and Technical Manager	:	CMA Ships, Marseille, France
Port of registry	:	Plymouth
Flag	:	United Kingdom
Type	:	Container ship
Built	:	1990, Samsung Shipbuilding & Heavy Industries, Korea
Classification society	:	Bureau Veritas
Construction	:	Steel
Length overall	:	242.25m
Gross tonnage	:	37235
TEU	:	2954
Service speed	:	22 knots

Accident details

Time and date	:	1031 on 28 January 2009
Location of accident	:	23º 04.0 N, 060º 20.0 E, Gulf of Oman
Persons on board	:	25
Injuries/fatalities	:	1 fatality, chief officer Mr Luis Sokota

1.2 NARRATIVE

1.2.1 The accident

On 28 January 2009, *Ville de Mars* was en route from Colombo, Sri Lanka, to Jebel Ali, UAE, where she was scheduled to arrive the following afternoon. During a ship inspection between 0900 and1000, the chief officer informed the master he intended to go with the bosun and inspect water ballast tank No 1 forward (WBT 1F) after the morning coffee break. The master was aware that the tank had been ventilated, and told the chief officer to take one more person with him. The need for permits to enter an enclosed space and for working at heights was not discussed and none were issued.

At approximately 1015, the chief officer met the master on the bridge while looking for a torch. The master took him to his cabin and gave him a large torch which did not have a shoulder strap. The chief officer then collected the bosun from the crew's mess and went to the deck department's changing room, where he put on relatively new wellington boots and cotton gloves. He was wearing a disposable white boiler suit over his overalls, with an ultra high frequency (UHF) hand-held radio slung across his chest. He also carried a camera and portable gas analyser in the chest pockets of his overalls. The chief officer and bosun then went to the main deck where they met the duty able bodied seaman (AB) and instructed him to accompany them to the ballast tank. The AB had a UHF radio, and both he and the bosun wore safety helmets; the chief officer did not.

The party entered cargo hold No 1 and made their way to the forward access of WBT 1F **(Figure 1)**. At 1030, the chief officer informed the third officer, who was the officer of the watch on the bridge, that he was about to enter the tank. He then took a reading of the tank's atmosphere by kneeling and reaching inside the access hatch with the gas analyser. The oxygen content was 20.9%[1]. He put the analyser back in his boiler suit pocket and descended through the open manhole into the darkened tank, holding the lit torch in one hand. The bosun stood at the tank access monitoring the chief officer's progress; the AB stood about 0.5m behind the bosun.

The chief officer stopped at the fifth or sixth wrung of the vertical ladder, almost level with a transverse stringer **(Figure 2)** through which the ladder continued. He then took another reading from the gas analyser and informed the bosun that the oxygen level was between 20.8% and 20.9%. The chief officer then stepped to his left onto the stringer.

At the same time, the bosun stepped back from the access and started talking to the AB. A few seconds later, there was a loud crashing sound in the tank. The bosun and AB looked inside and saw that the chief officer was no longer on the stringer. The bosun shone his torch into the tank and saw the chief officer lying at its bottom. The bridge was informed immediately.

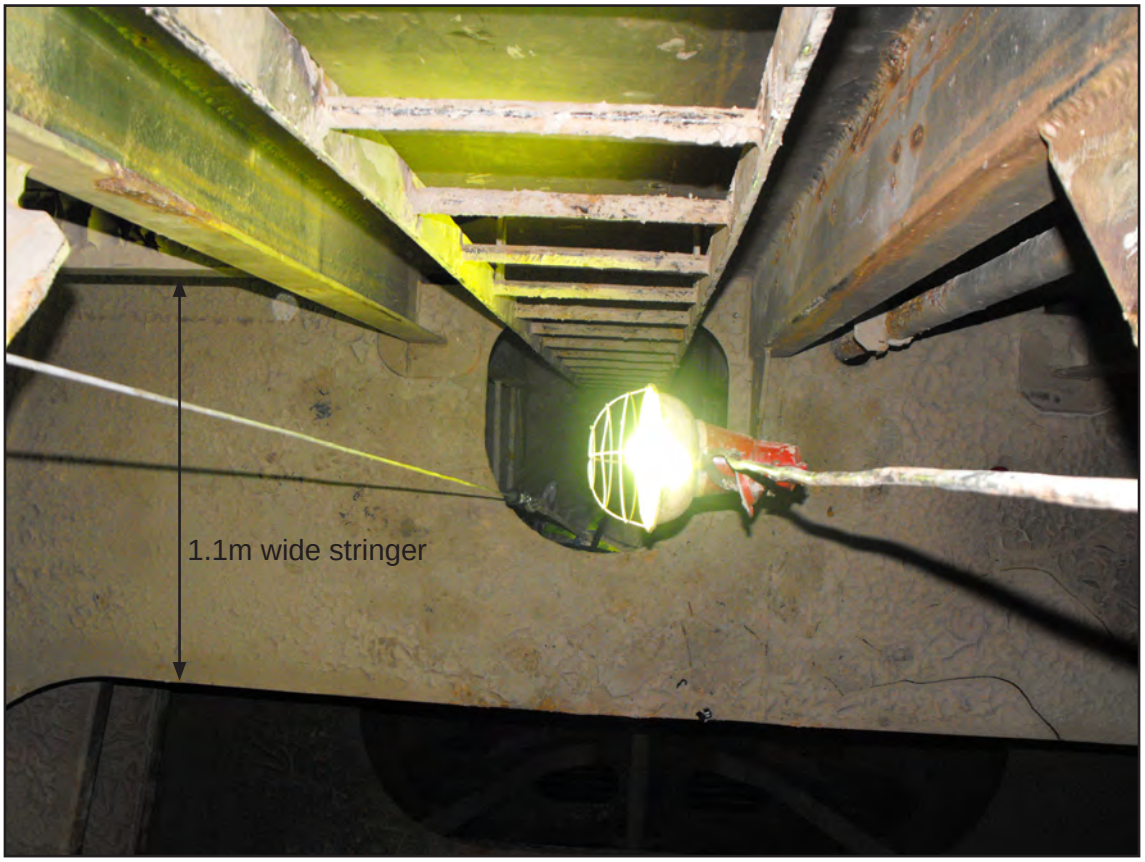
---

[1] Dry air contains, by volume, approximately 78% nitrogen, 21% oxygen and 1% other gases.

Figure 1

Access to WBT 1F in cargo hold No 1

Figure 2



Upper transverse stringer

1.2.2 Post accident response

At 1035, the third officer activated the general alarm. He also informed the master of the situation and broadcast the location and nature of the emergency on the public address system. When the master arrived on the bridge, he sent the third officer to help with the rescue and instructed the bosun to recover the chief officer from the tank as quickly as possible. He then called naval forces known to be in the area, by very high frequency (VHF) radio channel 16 to request helicopter assistance. No response was heard.

All crew not on watch rushed to the cargo hold. When the second engineer arrived at the tank's access he was concerned about entering the tank without breathing apparatus, but was reassured by the bosun that the chief officer had slipped and fallen; he had not been asphyxiated. Cargo lights were lowered through the opened manhole to illuminate the tank. Between seven and nine of the crew then entered the space, most remained on the transverse stringers but the second officer, third engineer and a deck fitter descended to the bottom of the tank.

The chief officer was unconscious and covered in mud, but he was breathing. His head was resting against the knee of a sub-frame and he had two deep cuts, one on his chin and the other at the back of his head; his ankle also appeared to be broken. The main body of his torch was on the tank bottom about 3m from the chief officer, and the portable gas meter was lodged on the second longitudinal from the bottom on the starboard side.

In preparation for his removal from the tank, the chief officer was secured onto a stretcher and harnesses and rope hoists were rigged. The chief engineer was at the tank access and was concerned at the severity of the chief officer's injuries. He called the bridge and suggested to the master that he should direct the operation. The master immediately recalled the third officer to the bridge and went to the cargo hold. He arrived just as the chief officer was brought out, and instructed the crew to take the chief officer into fresh air. By 1109, the chief officer had been set down on the starboard side of the main deck adjacent to container bay No 6.

The master returned to the bridge and informed the vessel's Designated Person Ashore (DPA) of the accident by telephone and asked him to arrange for the chief officer to be evacuated by helicopter. At 1120, the vessel's course was altered towards Muscat, Oman, which was 91nm away. The master tried to contact several medical centres before successfully establishing contact with a centre in Rijeka, Croatia. By 1130 the chief officer had gained consciousness and complained of severe pains in his stomach. He also had difficulty breathing and was given oxygen.

The chief officer stopped breathing at 1220. The second officer immediately started cardio pulmonary resuscitation (CPR), and within 5 minutes the chief officer started vomiting blood and fluids; CPR was continued. At 1250, the DPA informed the master that a helicopter had been arranged through the United Kingdom Maritime Trade Organisation (UKMTO). At 1407, a doctor was winched on board *Ville de Mars* from a Royal Navy helicopter. The chief officer was examined and was then winched up to the helicopter. He died at 1500 while en route to Muscat, Oman. The chief officer's body was later repatriated to Croatia; no postmortem was conducted.

1.3 WATER BALLAST TANK 1 FORWARD

WBT 1F **(Figure 3)** had a capacity of 406 cubic meters and was 12.2m deep. Access to the tank was via two manholes located in the deck of cargo hold No 1. The forward manhole opened to a vertical ladder attached to the tank's forward bulkhead which was strengthened by vertical stiffeners and by three transverse stringers. The transverse stringers extended along the width of the tank and were 1.1m deep; the drop from the top stringer to the tank bottom was 7.74m. The ladder was continuous as it passed through a hole cut into the top stringer and terminated at the middle stringer. A second ladder provided access from the middle stringer to the tank bottom via a hole cut into the bottom stringer. The outer edge of the area between the ladders on the middle stringer was protected by guardrails **(Figure 4)**. No protection was fitted on the outer edge of the top and bottom stringers

Both manhole covers were removed on 26 January 2009. Sixty cubic meters of water was pumped out, and the tank was ventilated using portable fans. The stringers and longitudinals were covered by a layer of sludge, which was up to 3cm thick in places, and made the surfaces very slippery. The layer of sludge was much thicker in the tank bottom. The tank had last been inspected on 23 January 2008 by a surveyor from Bureau Veritas (BV), the vessel's classification society.

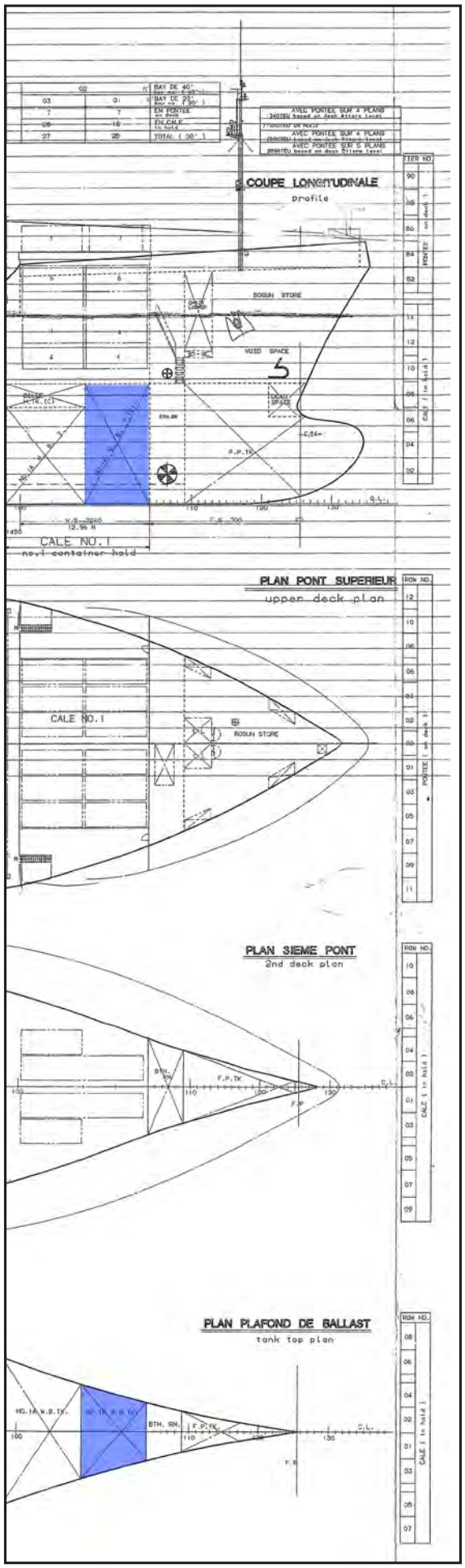
1.4 CREW

1.4.1 Nationality and language

The 25 crew comprised 6 Croatian officers and 19 Filipinos, of which 4 were junior officers. The working language on board was English.

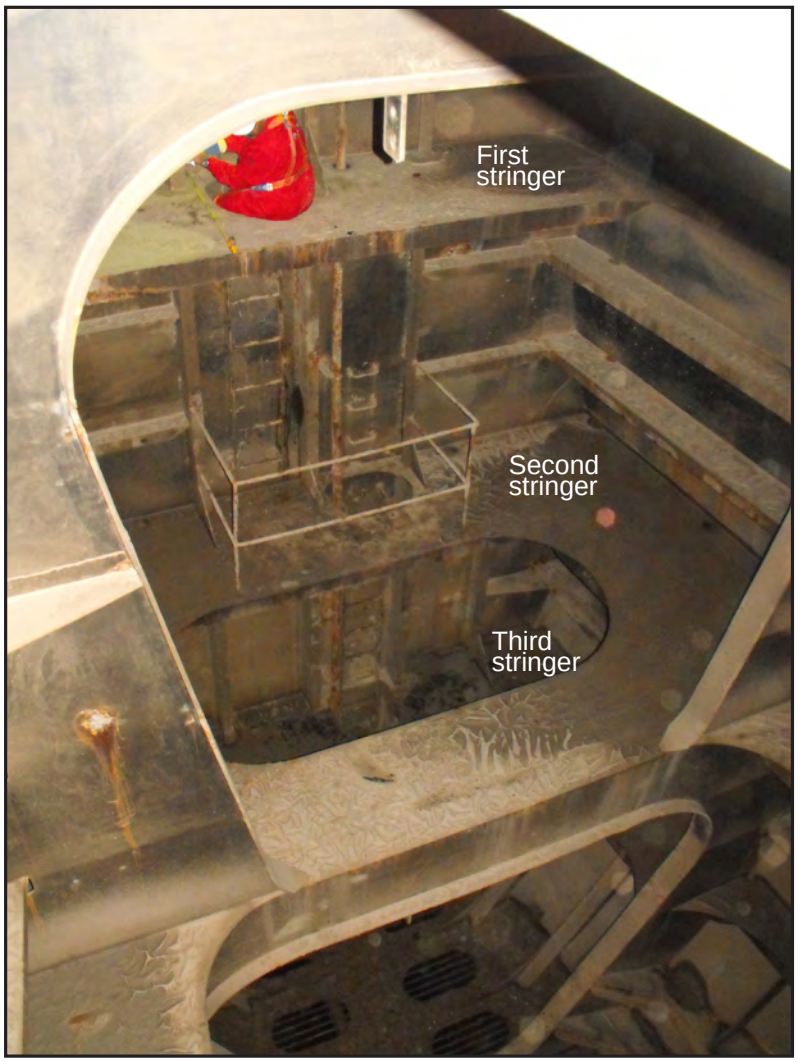
1.4.2 Chief officer

The chief officer was Croatian. It was his 34th birthday on the day of the accident and he was due to leave the ship the following day. He held a Croatian chief officer's certificate of competency and a UK certificate of equivalent competency (CEC), and had worked as a chief officer since 2002. Prior to joining *CMA CGM Okapi* in July 2007, which was his first contract with CMA Ships, he attended the company's offices in Marseilles, where he was briefed on various aspects of the company, including its safety management.



General arrangement showing the location of WBT 1F

Figure 4



Forward bulkhead with stringers, ladders and guardrails

The chief officer joined *Ville de Mars* on 10 September 2008, and during his time on board had viewed 21 Videotel computer based training modules including *Working aloft on container ships* and *Personal safety on container ships – part 8*. He had not viewed the module titled *Confined Space Entry* which was also available.

The chief officer was also the safety officer and chaired the vessel's weekly safety meetings. He was reported to have admonished crew who did not wear personal protective equipment when required. At sea, he kept the 0400 to 0800 and the 1600 to 2000 bridge watches and, except at weekends, he usually worked between 2 and 3 hours overtime after breakfast, and rested in the afternoon before going on watch. The chief officer had completed his record of hours worked up to, and including, 29 January 2009.

1.4.3 Master

The master was also Croatian and was 51 years old. He had held a master's licence since 1984, and had worked at sea as a master for 21 years. This was his first contract with CMA Ships, and before joining *Ville de Mars* in November 2008 he spent 2 days at its offices in Marseilles, where he was briefed on the activities of the company's departments, including the Safety, Security and Environment (SSE) department. His handover period with the vessel's previous master lasted 7 days.

The master was the chairman of the vessel's monthly safety and management committee and was a close friend of the chief officer, who he considered did not need to be told how to carry out his work safely.

1.4.4 Bosun

The bosun was a 49 year old Filipino who joined the vessel on 18 November 2008. He had worked as a bosun since 1999 and *Ville de Mars* was the third vessel managed by CMA Ships that he had served on. The bosun had carried out tank entries on other company vessels, but not on board *Ville de Mars*. During his time on board he had watched several Videotel training modules including those on working aloft and rescue from confined spaces, but he had not seen the module titled *Confined Space Entry*.

1.5 SAFETY MANAGEMENT SYSTEM (SMS)

1.5.1 Permits to work

The vessel's SMS comprised nine manuals and was issued in November 2004. It required permits to work to be raised for a number of situations, including when working aloft or over the side and when entering an enclosed space. The permit for working aloft required a "*Safety harness with parachute and lifeline"* [sic] to be worn. The permit for enclosed space entry required that breathing apparatus be available at the entry point and that a life-line, a harness and lighting be available for use.

Three signatories were required for a permit to be issued: *Team leader, Officer in charge* and *Competent person (atmosphere control)*. Permits for previous tank entries indicated that it was the chief officer's usual practice to nominate himself as the team leader and also to provide all three signatures **(Annex A)**.

Further requirements for entry into enclosed spaces detailed in the vessel's procedures included:

> *Rescue and resuscitation equipment should be available at the entrance. The rescue should be well coordinated, controlled and only be attempted when rescuers are wearing breathing apparatus, lighting, life-line, harness.*

There was no requirement for an emergency escape breathing device (EEBD) to be carried.

1.5.2 Safety equipment

Included in the vessel's safety equipment were: 5 sets of BA, an air compressor to charge the BA bottles, 12 EEBDs, 4 safety harnesses, 2 fall arrestors and 2 portable gas analysers. The gas analyser used by the chief officer was in date for calibration, but the calibration certificate for the other had expired in December 2008.

1.5.3 Safety meetings and drills

Weekly safety meetings were chaired by the chief officer and the chief engineer for their respective departments. In addition, monthly safety management meetings were chaired by the master, and minutes of these meetings were sent to CMA Ships. Safety drills were carried out every Saturday. Although a revised drill schedule was issued to the vessel on 5 December 2008, which required rescue drills from confined spaces to be conducted every 2 months in accordance with UK regulation, none were undertaken.

1.5.4 Emergency response

The SMS contained an Emergency Situations Guide (ESG) which included a *Serious injury, Sickness and illness* sheet *(SMM- 08-Em'cy-140),* which in the case of injury stated:

> *Make an examination of the vital functions and an examination of lesions, filling in the Medical Observation Sheet "SMM-080Em'cy-150".* The next step required that medical advice be sought from *SAMU at PURPAN hospital (CCMM) in Toulouse – Code 32 for Satcom* and then to carry the injured person to the hospital *in agreement with the doctor*

The ESG contained clear instructions for sending distress messages by *SATCOM C* which is an integral part of the global maritime distress safety system (GMDSS) and via *SATCOM A* and *SATCOM B* which are not part of the GMDSS, as well as via INMARSAT F (telephone).

1.5.5 Familiarisation

On joining vessels managed by CMA Ships, all deck officers were required to demonstrate knowledge in key areas detailed on three documents: *SMG-06-FAM-070 Appropriate Training Statement*, *SMG-06-FAM-005 Boarding Book For All Persons* and *SMG-06-FAM-010 Familiarisation Deck Officers*. These documents were signed by the chief officer to indicate his compliance with the requirement, but were not verified or signed by the master in accordance with the vessel's procedures.

Masters were required to conduct biannual reviews of their vessel's SMS. A review carried out by the master of *Ville de Mars* on 29 December 2008, stated:

> *The most important thing is to apply all SMS requirements and keep vigilant about safety matters. To bear in mind that the SMS is a good instrument to prevent hazardous situations and not only a paper work to be performed. Master's opinion is that crew members are familiar with safety equipment and comply with company's SMS standard.* [sic]

1.6 SHIP MANAGEMENT

1.6.1 Structure

CMA CGM Group is the third largest container ship company in the world, transporting 8.9 million TEU in 2008. It was formed in 1999 following the purchase of the former state-owned shipping company Compagnie Generale Maritime (CGM) by Compagnie Maritime d'Affretement (CMA). The group owns and manages 110 vessels and operates a further 275. CMA Ships, a fully-owned subsidiary, is responsible for the crewing and technical management of the group's fleet. The group's SSE department is responsible for safety management and is independent of CMA Ships.

1.6.2 Safety management

The CMA CGM Group employ four DPAs to cover its directly managed fleet, of which two are responsible for 28 UK registered vessels. The DPAs are employed within the SSE department and attend the group's twice yearly meeting of senior management. Each DPA has several assistants who each have responsibility for the safety and security management of between seven and eight vessels and usually visit each vessel at least once per year.

The SSE department is responsible for each vessel's SMS, the conduct and monitoring of internal ISM audits, and arranging external ISM audits. Other responsibilities include: the review of risk assessments for work-related activities on board the group's vessels; accident analysis and the distribution of lessons learned from accidents; and updating masters on regulatory changes.

1.6.3 Crewing

CMA Ships employs about 2500 seafarers, most of whom are engaged on short-term contracts. Approximately 500 French officers and ratings employed on board its French registered vessels, and about 75 officers of other nationalities employed on board its remaining vessels have permanent contracts. Crewing offices are located in Le Havre (for French registered vessels), Marseilles and London, and seafarers are recruited via manning agencies located in Croatia, Romania, Philippines, UK, Indonesia, Morocco and the Ukraine. As a principle, excluding the company's French flagged vessels which are predominantly manned by French nationals, CMA Ships employs mainly Croatian or other European officers and either Filipino or Romanian ratings on board its vessels. However, the company has recently promoted Filipino officers to chief engineer and master. CMA Ships also attempts to keep crews on the same vessel type by having at least three crews for every two ships. The normal contract length for officers is 4 months, although for Filipino junior officers it is 6 months. At the end of each contract, individuals receive a written appraisal, which is required to be signed by the person who has written it, and the seafarer concerned.

1.6.4 Familiarisation and training

All newly recruited masters and chief engineers are required to visit the CMA CGM offices in Marseilles to be briefed on the roles of its various departments and subsidiaries before joining a vessel. Since 2006, CMA Ships and the SSE department have also conducted several 2-day seminars to strengthen relationships between vessels' senior officers and the senior operations, crewing, technical and safety managers. The seminars have also been used to emphasise the importance of safety and safety management, and to conduct in-house training in topics including: the navigation of large container vessels, bridge team management, high voltage equipment and electronic engines.

1.7 AUDITS, SURVEYS AND INSPECTIONS

1.7.1 Audits

When *Ville de Mars* was registered with the UK administration in October 2007, the Maritime and Coastguard Agency (MCA) conducted a renewal audit of the vessel's safety management system. Five non-conformities were issued, all of which were addressed within the agreed timescales. In May 2008, an internal audit by the SSE department identified five further non-conformities, one of which was raised because a permit to work for a tank entry carried out by the chief engineer could not be found. This non-conformity was reported as 'rectified' several weeks later, but no supporting evidence was provided or available to indicate what action had been taken. Another non-conformity identified during the internal audit, which concerned the recording of lifeboat movements from their stowage, had also been raised during a previous internal audit in 2007. The SSE department intended to verify the rectification of these non-conformities during the ship's next audit in 2009.

1.7.2 Tank surveys and inspections

In addition to inspections conducted by classification societies, CMA Ships required the ballast tanks in its vessels to be inspected annually. These inspections were primarily to detect any incidence of structural damage that might be caused by contact with tugs. In August 2008, five ballast tanks were surveyed by BV on board *Ville de Mars,* but no permits to work were issued. During his time on board, the chief officer conducted 15 tank entries, the majority of which were double bottom tanks. During two tank entries on 25 and 26 September, the inspections were conducted by two deck fitters and a deck fitter and an AB respectively, with the chief officer supervising from outside the tank. During the remaining 13 tank entries, the chief officer entered and inspected the tanks, accompanied by the bosun with an AB stationed at the tank entrance. Before entering a tank, the chief officer arranged for the space to be lit, and donned a safety helmet; he never arranged for any rescue equipment to be made ready. No permits to work aloft were issued for any of the entries into the vessel's deep tanks. The entry into WBT 1F was the first tank entry since the master had joined the vessel.

1.8 ENTRY INTO DANGEROUS SPACES (EDS)

1.8.1 Merchant Shipping (Entry into Dangerous Spaces) Regulations 1988

The Regulations apply to United Kingdom (UK) ships and other nations' ships while they are in a UK port. The regulations define "dangerous space" 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.*

The Regulations require that: entrances to unattended dangerous spaces are secured against entry; procedures for entry into dangerous spaces are laid down and observed; drills are periodically carried out; and that equipment for testing dangerous spaces is carried where entry into a dangerous space might be necessary.

1.8.2 Duties under the Entry into Dangerous Spaces (EDS) Regulations

The regulations require:

- The employer shall ensure that procedures for ensuring safe entry and working in dangerous spaces are clearly laid down; and
- The master shall ensure that such procedures are observed on board the ship.
- No person shall enter or remain in a dangerous space (except in accordance with safe procedures).
- In fulfilling their duties under these regulations, the employer, master and any other person shall take full account of the principles and guidance contained in the Code of Safe Working Practice for Merchant Seamen (COSWP)[2].

1.8.3 Entry into enclosed spaces leaflet MCA/198

The MCA leaflet *Entry into Enclosed Spaces* identifies the precautions to be taken for entering a confined space. It does not alert the reader to the hazard of falling when entering a deep tank.

1.9 WORKING AT HEIGHT

1.9.1 COSWP

With regard to working at height, COSWP states:

> *Personnel working aloft (above 2m) should wear a safety harness with lifeline or other arresting device at all times. A safety net should be rigged where necessary and appropriate.*

---

[2] The COSWP is published by the MCA, and is mandatory for UK ships. Regulations place a duty on the ships' operators to ensure that sufficient copies of the COSWP are carried on every ship to which the regulations apply, based on the number of workers on the ship.

The publication does not identify the risk of falling into a deep tank, and deals with confined space entry and working aloft procedures separately.

1.9.2 The Merchant Shipping and Fishing Vessels (Work at Height) Regulations 2009

On 15 May 2009, the MCA completed the consultation process of *The Merchant Shipping and Fishing Vessels (Work at Height) Regulations 2009* which implements EU Council Directive 2001/45/EC. The draft regulation defines work at height as:

(a) work in any place, including:

(i) work alongside an open hatch or other opening in a ship's structure; and

(ii) work in close proximity to, or supported from, a ship's side; or

(b) obtaining access to or egress from any place while at work except by a permanent stairway or companionway in or on a ship.

1.10 INSPECTIONS AND MEANS OF ACCESS

1.10.1 SOLAS

An administration (or recognised organisation acting on its behalf) is required under the International Maritime Organization's (IMO) enhanced survey programme (ESP) to perform close up inspection of areas most susceptible to corrosion or damage in tankers and bulk carriers. SOLAS Part A-1: Regulation 3-6 *Access to and within spaces in cargo area of oil tankers and bulk carriers* refers to Maritime Safety Committee (MSC) resolution MSC 133(76)[3] which contains *Technical provisions for means of access for inspections*. This states:

Openings in stringer plating utilized as permanent means of access shall be arranged with guard rails or grid covers to provide safe passage on the stringer or safe access to each transverse web.

1.10.2 Bureau Veritas (BV) Rules

BV's rules in force when *Ville de Mars* was built did not require guardrails to be fitted to stringers within tanks. Chapter 2, section 3, article 3.3 of the society's rules titled *Large cargo holds, large tanks and large water ballast tanks,* which came into force in 2000, states:

Shelves and platforms forming a part of the access to the tanks are to be of non-skid construction where practicable and be fitted with guard rails.

This requirement applies to all ship types.

---

3 MSC.158(78) adopted on 20 May 2004 amends MSC.133(76)

1.11 PREVIOUS ACCIDENTS

Excluding accidents such as falling overboard, falling from stairs, ladders and other elevated positions, five fatalities caused by falls from height from or below main deck level on board vessels over 100GT have been reported to the MAIB:

In 2000, a pump man on board the oil tanker *Inga* died when he fell through an open hatch cover of the pump room. In the same year, a third officer was killed on board the bulk carrier *Evangelos CH* in similar circumstances. In 2007, a specialist contractor engaged in grit blasting a ballast tank on board a liquid natural gas (LNG) carrier fell to his death when he slipped from an incorrectly assembled and unfenced scaffolding stage. He had temporarily removed his safety harness.

In 2008, a fitter who was welding near an unguarded open hatch cover on board the container ship *Varmland* died when he fell 10m into the hatch. Although permits for working aloft were required by the ship's SMS, none was generated as the hatch covers were meant to be closed during the work. Again in 2008, a shore fitter died when he fell nearly 9m through a poorly fenced engine room hatch cover on board an offshore supply vessel.

SECTION 2 - ANALYSIS

2.1 AIM

The purpose of the analysis is to determine the contributory causes and circumstances of the accident as a basis for making recommendations to prevent similar accidents occurring in the future.

2.2 THE FALL

Without an eye witness, it is not known exactly how or why the chief officer fell. Given the oxygen levels measured during his entry, and that none of the crew who rescued him from the tank wore BA, it is extremely unlikely that he lost consciousness through asphyxiation. It is also extremely unlikely that he fell through the access hole in the first stringer, otherwise he would have landed on the middle stringer where the ladder terminated. Also, had the chief officer fallen backwards from the ladder, he would probably have landed near the centreline, not on the port side of the tank. Therefore, as the chief officer stepped onto the stringer moments before he fell, it is almost certain that he fell off its un-guarded edge, possibly as a result of slipping on its sludgy coating while holding his torch in one hand and the gas analyser in the other.

2.3 PRECAUTIONS

By ventilating the tank and checking its atmosphere before entry and during descent, the chief officer showed that he was aware of the danger of asphyxiation in the enclosed space. However, his failure to raise a permit to work and the lack of lighting, BA, a harness and lifeline, EEBD's, a second calibrated gas analyser, and a safety helmet indicate that the chief officer was not concerned about the possibility of something going wrong when inside the tank which would have required the rescue of himself and/or the bosun. The precautions taken before the chief officer's entry into the tank fell significantly short of the requirements of the vessel's procedures, the expectations of the vessel's managers, and industry best practice.

It is possible that the chief officer felt under pressure to complete the tank inspection before leaving the vessel the following day. However, apart from not raising a permit to enter the enclosed space and ensuring that the space was lit, his preparation for this entry was little different to his 15 previous entries on board. On this occasion, the absence of lighting was significant. The chief officer was totally reliant on his torch, which was probably of limited use as he descended the ladder.

No permits to work aloft had been issued for the tank entries on board *Ville de Mars,* and their absence had not been identified during the audits conducted. This indicates that the danger of falling during tank inspections had not been recognised or considered. Consequently, although two fall arrestors were carried on board, they were never used for the entry into deep tanks. The risk of falling

when descending into a deep tank is no less than the risk posed when working at height above a main deck, a point which should be emphasised in the relevant regulations and guidance such as COSWP.

2.4 EVACUATION FROM THE TANK

2.4.1 Tank entry

When alerted to the chief officer's fall, the crew responded very quickly, but their decision to enter the tank without BA or measuring the oxygen content of its atmosphere was highly questionable. It was based on the reported readings from the gas analyser taken at the top of the tank and the assumption that the chief officer had slipped. However, the crew did not know the oxygen content of the atmosphere at the tank bottom and do not appear to have considered the possibility of noxious substances such as hydrogen sulphide being dislodged from the thick sludge. Furthermore, after assuming that the chief officer had slipped, his rescuers also did not consider the use of harnesses or fall arrestors to prevent them having a similar accident.

Numerous fatalities and injuries have resulted from would-be rescuers rushing into enclosed spaces without first taking appropriate precautions. On this occasion, although, like in the many previous accidents, the crew's entry into the tank was well-intended, it was extremely fortunate that further casualties did not result. Had rescues from enclosed spaces been practised on board as required by the EDS regulations, not only would the crew have been better prepared for this emergency, but also the drills would have identified the need for strong leadership at the scene and for rescue equipment to be provided before the entry was commenced.

2.4.2 Moving the chief officer

It is understandable that the master wanted to have the chief officer removed from the ballast tank as quickly as possible. Moving a casualty from an uncomfortable environment is frequently an instinctive response, but such action can be dangerous and is best delayed, if possible, until expert medical advice is available. However, the circumstances of different accidents vary considerably and, although procedures provide a firm basis for any action taken, this decision must rest with the person in charge at the scene. On this occasion, the absence of a postmortem prevents any further analysis of the consequences, if any, of the removal of the chief officer from the tank.

2.5 EVACUATION FROM THE SHIP

In some areas of the world it is not always apparent who to call when in need of assistance. The master's attempt to contact naval forces known to be in the area was reasonable given the likely resources that would be available. When contact could not be established with these vessels, although the request made to the DPA to arrange for an evacuation was sensible, the use of Inmarsat or Digital Selective Calling (DSC) to establish contact with a rescue co-ordination centre

would also have been an appropriate precaution to have taken. This might have resulted in the chief officer's evacuation from the vessel being arranged sooner. The procedure for transmitting a distress message was well defined in the SMS, and the system is there to be used when life is in danger.

2.6 PERMIT TO WORK SYSTEM

A permit to work system is a formal written system used to control potentially hazardous tasks. The permit is a written document authorising certain people to carry out specific work at a certain time and place, and which details the main precautions necessary to complete a job safely. In this case, the repeated failure to issue permits, and the failure to take the precautions detailed on the permits on the occasions they were issued, clearly indicates that the permit to work system on board *Ville de Mars* was ineffective. It lacked clarity regarding the level of authority required to issue a permit and the chief officer's multiple signatures defeated the purpose of allocating different responsibilities for completing the task. Similar to the premature completion of his record of hours of rest, the permits were probably only signed to satisfy the requirements of the vessel's SMS. Indeed, given the absence of a permit for the chief officer's last tank entry, it is conceivable he signed the permits for his previous entries after the tank inspections had been completed.

The failings of the vessel's permit to work system were identified during the internal audit in May 2008, which highlighted that the chief engineer on board at the time had not issued permits for tank entries. Although a non-conformity was raised, this was quickly reported as rectified without any substantive action being taken. This paid lip-service to the audit process and allowed the underlying problem to remain unaddressed. The identification of a non-conformity is a warning to a vessel's master and shore management that procedures are not being followed. For audits to be effective, this should trigger investigation, analysis, and corrective action. On this occasion, and possibly with regard to the non-conformity concerning the movement of lifeboats from their stowages, it did not.

2.7 PROTECTION ON MEANS OF ACCESS

The stringer from which the chief officer fell was wide enough to stand on comfortably but, unlike the stringer below which was a permanent means of access between the two vertical ladders, it was not required to have guardrails fitted. The requirements of MSC 133(76) apply only to structures in the tanks of oil tankers and bulk carriers which are also designated as permanent means of access for the purpose of inspection.

Although the location of the stringer made it easy to step onto when descending the ladder, it was not a means of access, and there was no requirement for the chief officer to use the stringer in order to get to the tank bottom. WTBT 1F was a potentially hazardous space protected by manhole covers. The removal of

these covers should have initiated a permit to work system requiring the space to be lit and the persons entering to wear fall arrestors or harnesses. Had these precautions been taken, the possibility of falling from the stringer to the tank bottom would have been eliminated.

2.8 TACKLING COMPLACENCY

Complacency is a natural human behaviour in response to repeated exposure to situations in which no adverse consequences are experienced. This inevitably results in people feeling comfortable, and induces an attitude of 'it won't happen to me'. In turn, this leads to shortcuts being taken and procedures being ignored. In this case, examples include:

- The failure to issue a permit to work.
- The absence of rescue equipment at the tank access.
- The absence of adequate lighting.
- The failure to wear a fall arrestor or harness, and a safety helmet.
- The entry into the tank by the rescuers without wearing BA or fall arrestors, and without confirming the oxygen content of the atmosphere.
- The lack of oversight of his tank entries by either master during the chief officer's contract.
- The reluctance of the master to check on the chief officer's compliance with onboard safety procedures.
- The master's 'rectification' of the non-conformity regarding the non issue of permits to work without any notable corrective action being taken.

Preventing this kind of behaviour, to which everyone is susceptible and which is a recurring safety issue in many accident investigations, is difficult even in shore-based workplaces where management is on site. Preventing it at sea, where ship owners and managers are frequently thousands of miles from their vessels, is a huge challenge.

The provision of credible procedures is an essential building block in this respect, but the role of masters is pivotal; they are in charge of the vessels and are responsible for the safety of their crew. To ensure that safety habits are developed rather than short cuts taken, masters must lead by example, set high professional standards and insist that safety procedures are followed at all times. In hindsight, the *Ville de Mars* master's assessment of his crews' familiarity with safety equipment, and their compliance with onboard safety procedures, which was made within weeks of joining and less than 1 month before the chief officer's death, proved to be extremely optimistic and inaccurate.

The role of audit is also important in identifying where procedures are not followed and ensuring that successful corrective action is taken. However, complacency was also evident within the company's shore safety management, which was content for the non-conformity relating to permits to work to be 'rectified' without question.

It is apparent from its crewing and familiarisation policies, and its safety management organisation, that CMA CGM takes its responsibility for the safety of its vessels and crews very seriously. However, the complacency demonstrated at all levels which led to important safety procedures on board *Ville de Mars* being disregarded is concerning. It is apparent that more work needs to be done by CMA CGM to find ways of engaging with its masters, crews and shore-based managers to instil and maintain a positive safety culture across its fleet. The help of human factors experts should be considered in this respect. As the results of such work might possibly contribute to general marine safety, its findings should be shared with industry.

SECTION 3 - CONCLUSIONS

3.1 SAFETY ISSUES DIRECTLY CONTRIBUTING TO THE ACCIDENT WHICH HAVE RESULTED IN RECOMMENDATIONS

1. The precautions taken before the chief officer's entry into the tank fell significantly short of the requirements of the vessel's procedures, the expectations of the vessel's managers and industry practice. [2.3]

2. The repeated failure to issue permits to work for enclosed spaces and the failure to take the precautions detailed on the permits on the occasions they were issued, clearly indicates that the permit to work system on board *Ville de Mars* was ineffective. [2.6]

3. The action taken following the identification of a failure to use the permit to work system paid lip-service to the audit process and allowed the underlying problem to remain unaddressed. [2.6]

4. Complacency at all levels led to important safety procedures being disregarded on board *Ville de Mars*. Work is required to find ways in which a positive safety culture can be successfully instilled in ships' crews. [2.8]

3.2 SAFETY ISSUES IDENTIFIED DURING THE INVESTIGATION WHICH HAVE NOT RESULTED IN RECOMMENDATIONS BUT HAVE BEEN ADDRESSED

1. The danger of falling during tank inspections had not been recognised or considered [2.3]

2. Had rescues from enclosed spaces been practised on board, as required by the EDS regulations, not only would the crew have been better prepared for this emergency, but also the drills would have reinforced the importance of preparing the rescue equipment before the entry was commenced. [2.4]

SECTION 4 - ACTION TAKEN

4.1 MCA

MCA has undertaken to:

- Amend COSWP and its *Entry into Enclosed Spaces* leaflet (MCA/198) to include the risk of falling into a deep tank in the context of both working aloft and confined space entry.
- Include the entry into deep tanks as an example of working at heights in its forthcoming MGN on *The Merchant Shipping and Fishing Vessels (Work at Height) Regulations 2009*.

4.2 CMA CGM GROUP

CMA CGM Group has:

- Carried out an internal investigation and conveyed the findings to all the vessels in its fleet.
- Conducted two additional ISM internal audits on board *Ville de Mars.*
- Instructed all crew involved with enclosed space entry and rescue to watch appropriate training videos.
- Informed its vessels of the requirement to conduct drills in accordance with the EDS regulations.
- Supplied two new multi-gas analysers to each of its vessels and prohibited all enclosed space entries unless both analysers are in date for calibration and functioning correctly.
- Reviewed all permits to work procedures and checklists.
- Held a safety seminar for a number of senior officers.

SECTION 5 - RECOMMENDATIONS

CMA CGM Group is recommended to:

2009/161 With the help of human factors experts, conduct a study to try and identify ways of developing a positive safety culture and reducing complacency on board its ships, and to share the results of this study with others via the MCA's Human Element Advisory Group.

2009/162 Review and improve its internal audit procedures such that follow up action taken to address non-conformity is properly documented and verified.

Marine Accident Investigation Branch
September 2009

Annex A

Copy of a '*Permit for Enclosed space work'* dated 29 October 2008

Permit for Enclosed space work

Points to check and form to be filled before any entering in an enclosed space, additional to the points mentioned in « Permit Special work » (Card SMM-07-PREAC-190)

IMPORTANT : every enclosed space may induce severe hazard for the staff by OXYGEN SHORTAGE, even if the capacity is a void space or is usually filled with water.
The older the ship, the greater the danger (oxidation)

RELEVANT CAPACITY OR AREA : **DB 2 STB**

Entry point : **AFT MANHOLE** Exit point : **FWD MANHOLE**

Staff entering the capacity (names) : LUIS SOKOTA Rank : CH. MATE (Team leader)
Rank : BOSUN
Rank :

Person on duty at the entry point (name) : [redacted]

Atmosphere controlled by (name) : **LUIS SOKOTA** Rank: **CH.MATE**

Result : Oxygen 20.7 Low Flash Point :

TOXIC ATMOSPHERE: YES / NO

Duty officers informed : Bridge : **YES** Deck : **YES** ECR :YES

Type of ventilation : EXHAUSTING FANS

Communication means : WALKIE TALKIE, CH.72

Breathing apparatus standing at entry point : YES Safety means checked and ready for use : YES

Breathing apparatus in good condition : YES Life-line, harness, lighting : YES

Signature :

Team leader

Officer in charge

Competent person (atmosphere control)

Date : 29TH OCTOBER 2008. Hour : 11:30

THIS CERTIFICATE IS VALID FOR 24H MAXIMUM