DANISH MARITIME AUTHORITY

MARINE ACCIDENT REPORT
DIVISION FOR INVESTIGATION OF MARITIME ACCIDENTS

ESTELLE MÆRSK

Accident to seafarers on 30 October 2009

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Case: 200913680

The casualty report is available on our homepage: www.dma.dk.

The Division for Investigation of Maritime Accidents

The Division for Investigation of Maritime Accidents is responsible for investigating accidents and serious occupational accidents on Danish merchant and fishing vessels. The Division also investigates accidents at sea on foreign ships in Danish waters.

Purpose

The purpose of the investigation is to clarify the actual sequence of events leading to the accident. With this information in hand, others can take measures to prevent similar accidents in the future.

The aim of the investigations is not to establish legal or economic liability.

The Division's work is separated from other functions and activities of the Danish Maritime Authority.

Reporting obligation

When a Danish merchant or fishing vessel has been involved in a serious accident at sea, the Division for Investigation of Maritime Accidents must be informed immediately.

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Contents

1 Summary

Whilst the container ship ESTELLE MÆRSK was at anchor off Yantian, China, it was decided to dismantle one of the main engine's 14 fuel injection control units (ICU) in order to repair a minor fuel oil leakage from the sealing between the ICU and the fuel oil rail to which it is connected.

The job was to be carried out by the ship's 2nd engineer, 3rd engineer and a cadet. No "Safe Job Analysis" or work risk assessment was prepared, and no tool box meeting was held prior to initiating the job.

All relevant valves in the fuel oil system were operated to prevent fuel oil from flowing out during the repair work.

However, the fuel oil rail was still heated due to steam tracing, which was not shut off. Thus some hot fuel oil kept flowing out from the fuel oil rail disturbing the 2nd engineer's work. To stop this oil flow a rag was stuffed into the bore.

Suddenly the rag popped out from the bore, and hot fuel oil splashed upwards hitting both engineers' eyes, faces and arms.

The engineers suffered severe burns and were evacuated by a tug boat and subsequently hospitalized.

2 Conclusion

2.1 Immediate causes (6.1)

Unsafe actions:

- Stuffing a rag into the bore made it possible to build up a pressure inside the fuel oil rail.

- Continued heating of the fuel oil rail is likely to have caused a pressure build-up inside the rail due to gasification of fuel oil constituents.

Unsafe surroundings:

- All necessary technical precautions and measures were not identified and taken to depressurize the fuel oil rail before initiating the work, uncertainties exist to whether valves were effective or not.

- It remains uncertain whether the main engine's fuel oil supply and fuel oil return lines shut off were effective.

- The by-pass did not function effectively in terms to prevent pressure build-up in the piping system.

- The safety valve on the intermediate rail was kept mechanically open to hinder pressure build-up, but this did not prevent pressure build-up in the piping system.

2.2 Contributory causes (6.2)

The safety system:

- A proper risk assessment had not been carried out and the "Permit to Work system" had not been initiated for the job as required in accordance with the company's Safety Management System.

- The lack of initiation of the company's safety procedures and lack of holding a proper tool box meeting prior to initiating the work resulted in the steam tracing was not shut off.

3 Recommendations and initiatives

The Division for Investigation of Maritime Accidents notes that this accident in many aspects is similar to other occupational accidents especially two which occurred in the container ship SORØ MÆRSK on 4 November 2008 and in the oil and chemical tanker NORDBY MÆRSK on 15 August 2009 (see Appendix in chapter 7).

Work risk assessments / Safe Job Analysis are not always prepared in advance for any detailed task that perhaps is carried out seldom. Therefore, according to the company's Safety Management System, risks and safety should be talked over and a Safe Job Analysis must be prepared before initiating any such job.

The Division for Investigation of Maritime Accidents recommends the shipping company to implement in the safety system that the management should ensure that safety is discussed whenever planning any work.

Based on this accident the shipping company issued and distributed a “Safety Flash” to the fleet in November 2009.

This Safety Flash contains the event description and a number of detailed “on board recommendations”, “on shore tasks” and “SJA minimum criteria” (subject to engine type).

4 The investigation

The Division for Investigation of Maritime Accidents has received the master’s and the chief engineer’s report on the accident as well as statements from a witness, Personal Injury Report for both injured engineers, log book entries, Safety Committee agenda and minutes, drawings and photographs of the ICU and the fuel oil rail in question.

The chief engineer has given a statement to the Division for Investigation of Maritime Accidents**.**

The Division for Investigation of Maritime Accidents has received information from the shipping company about details of the fuel oil system and about the company’s initiatives to prevent future accidents.

5 Factual information

5.1 Accident data

Type of accident (the incident in details)	Accident to seafarer Two engineers scalded by hot fuel oil
Time and date of the accident	30 October 2009, 1400 hours
Position of the accident	22°34.6’ N – 114°21.7’ E
Area of accident	Yantian anchorage, China
Injured persons	2nd engineer and 3rd engineer

5.2 Navigation data

Stage of navigation	At anchor
Port of departure	Yantian
Date and time of departure	30 October 2009, 1130 hours

5.3 Ship data

Name	ESTELLE MÆRSK
Home port	HELLERUP
Call sign	OVXO2
IMO No	9321495
Owner and ISM responsible operator	A.P. Møller - Mærsk A/S
Flag State	Denmark
Construction year	2005
Type of ship	Container ship
Tonnage	170,794 GT
Classification Society	American Bureau of Shipping
Length over all	397.71 metres
Engine power	72,072 kW

5.4 The Crew

Number of crewmembers	24
Crewmembers relevant to the accident	**Age, citizenship, Certificate of Competency, service at sea**
Chief engineer	41 years of age, Danish citizen, certificate as a chief engineer, served in this company for 18 years
2nd engineer	28 years of age, Indian citizen, certificate as a 2nd engineer, served in this company for 7 years
3rd engineer	26 years of age, Indian citizen, certificate as an engineer officer, served in this company for 4 years

5.5 Narratives

On 30 October 2009 at 1130 hours, ESTELLE MÆRSK departed from Yantian, China, for Hong Kong.

When leaving Yantian a minor fuel oil leakage was discovered between the ICU (Injection Control Unit) and the fuel oil rail on which the ICU was connected on the main engine, cylinder 13.

The ICU had been exchanged in Yantian the day before with ship's spare.

Shortly after the departure the ship anchored in Mirs Bay off Yantian for schedule reasons.

When it was decided to anchor off Yantian, it was also decided to dismantle the ICU in order to check the sealing disc and packing surfaces on the fuel oil rail and the ICU.

This task was carried out by the 2nd engineer and the 3rd engineer assisted by a cadet, and it was approved by the chief engineer.

Before the dismantling the fuel oil supply and fuel oil return lines to the main engine were closed and a by-pass was opened in order to depressurize the ICU, and the safety valve on the intermediate rail was mechanically kept in an open position enabling fuel oil to drain from the rail.

When the pressure was confirmed 0 bar, the work commenced. The ICU was loosened and lifted from the fuel oil rail and placed upon the floor plate next to the main engine. The sealing disc between the ICU and the fuel oil rail was removed and the surfaces were cleaned.

During the cleaning work hot fuel oil kept flowing from the rail, and in order to prevent oil leaking a rag was stuffed into the bore acting as a plug enabling cleaning of the packing surfaces.

The 2nd engineer was sitting on the platform above the fuel oil rail with a leg on each side of the rail using a scraper in order to clean the surface.

The 3rd engineer was kneeling on the floor plates next to 2nd engineer working with the dismantled ICU.

The cadet arrived to the work scene a little later and worked with cleaning the bolts.

When ready to reinstall the ICU, the rag popped out of the bore and hot heavy fuel oil from inside the rail splashed right up and hit the 2nd engineer and the 3rd engineer in their faces and eyes and lower arms causing severe burns.

The cadet was not hit by the fuel oil.

It is uncertain whether the rag was pulled from the oil bore, or it accidentally was hit by the scraper thus pulling it a little, or it suddenly came out due to pressure built up inside the fuel oil rail.

Both engineers suffered severe burns to their faces, eyes and arms. The 2nd engineer became more badly injured than the 3rd engineer.

After the accident both engineers were helped into the workshop where first aid was initiated by flushing water onto the scalded surfaces. The duty officer was called for and the master and the chief officer were notified.

The injured engineers were taken to the ship's hospital where the chief officer continued giving first aid to the engineers.

The master called the ship's agent in Yantian on VHF for assistance to evacuate the injured persons and contacted Radio Medical in Denmark for advice.

A tugboat from Yantian brought the injured engineers ashore and they were hospitalized for further treatments.

5.6 Preparation of work

A SJA (Safe Job Analysis) and Permit to Work had not been prepared for this task as required for jobs involving pressure and high temperature

There is no evidence that a tool box meeting was held with the persons involved before the work was initiated.

However, the engineers in question were acquainted with the job, because this very ICU was exchanged the day before, and all 14 ICUs were exchanged in Bremerhaven on 10 and 11 September 2009.

5.7 Temperatures

The fuel oil temperature is normally approximately 130 °C.

The steam temperature in the steam tracing was 140 - 150 °C (estimated).

5.8 Extraordinary Safety Committee Meeting

In the morning on 1 November 2009 the chief engineer held a meeting with all engine personnel where the accident had happened and how to prevent similar accidents was discussed.

Furthermore on 1 November 2009 an extraordinary safety committee meeting was held on board ESTELLE MÆRSK in order to consider future actions to avoid similar accidents based on the accident findings.

The accident was discussed by the committee members and as a meeting already had been held by the engine department no further suggestions/actions were raised by the committee members. However, it was agreed there should be more focus on work risk assessment (SJA and tool box meetings) before jobs like this are carried out.

The safety committee referred to the Personal Injury Reports that already had been issued and forwarded to the company.

According to the Personal Injury Reports the heavy fuel oil inside the rail would not have been hot enough to build up a pressure in the rail, if the steam tracing heating had been shut off.

Furthermore, according to the Personal Injury Report the ship's management is suggesting as a preventive action it shall be ensured that continued heating of fuel oil is avoided whilst working at the system, even when depressurized.

5.9 The ship management's findings

According to the master's and the chief engineer's report to the Division for Investigation of Maritime Accidents the accident was most likely caused by two things:

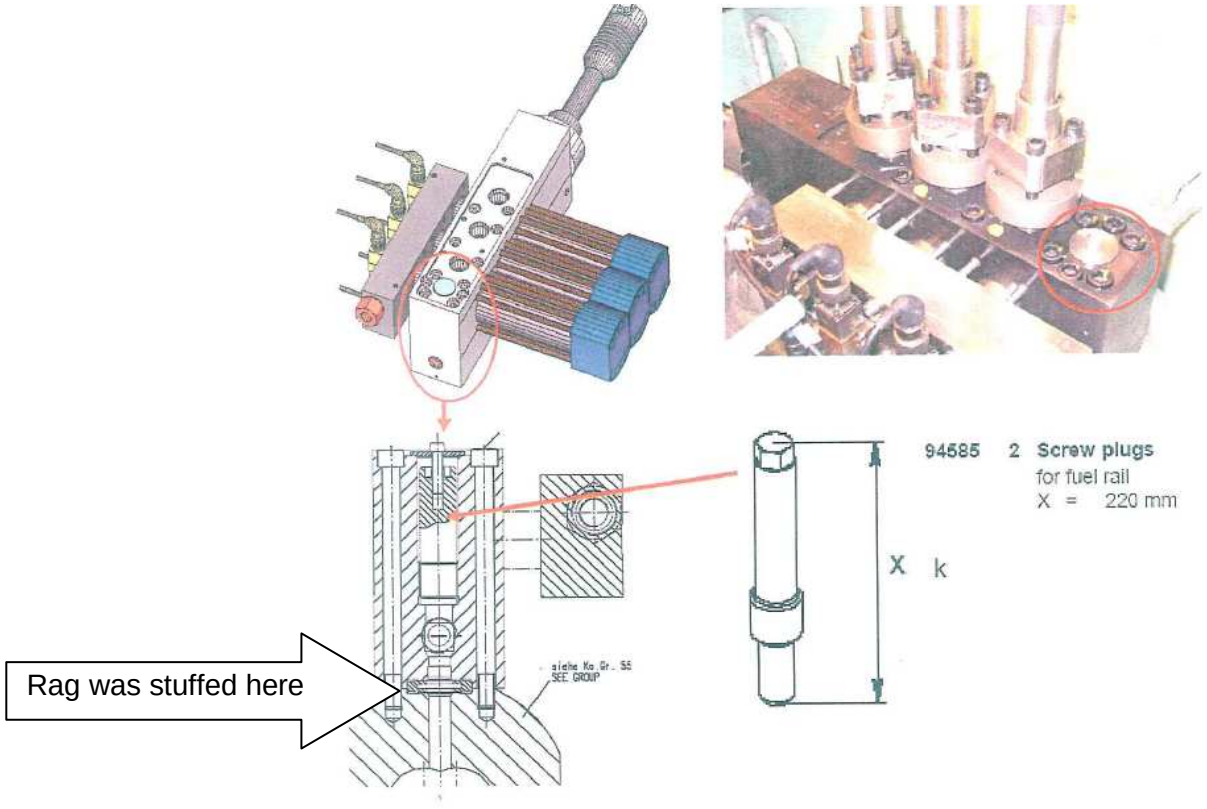
- The steam tracing heating for the fuel oil rail was not closed prior to work start.
- A rag was used to plug the bore in the fuel oil rail.

These circumstances in combination enabled a pressure build-up in the fuel oil rail, even after it was confirmed to be pressure less (0 Bar), and even though the safety valve was kept open in order to release any pressure in the fuel oil rail and intermediate fuel oil rail.

5.10 The work scene

Upper platform of the main engine Photo: Chief engineer of ESTELLE MÆRSK

The ICU situated on the fuel oil rail Photo: Chief engineer of ESTELLE MÆRSK



6 Analyses

6.1 Immediate causes

Unsafe actions

Fuel oil was flowing from the rail whilst working with it, and therefore a rag was stuffed into the bore on the rail to stop the flowing of fuel oil.

The steam tracing was not shut off prior to initiating the work.

The Investigation Division considers that stuffing a rag into the bore made it possible to build up a pressure inside the fuel oil rail.

The Investigation Division considers that the continued heating of the fuel oil rail is likely to have caused a pressure build-up inside the rail due to gasification of fuel oil constituents.

Unsafe surroundings

Fuel oil was flowing out from the fuel oil rail, even though the main engine's fuel oil supply and fuel oil return lines were closed, a by-pass was opened and the safety valve on the intermediate rail was kept mechanically open to hinder pressure build-up.

This did not prevent pressure build-up in the piping system.

There was steam tracing heating on the fuel oil line whilst working with the ICU and the fuel oil rail.

A pressure was being built up inside the rail because a rag was stuffed into the bore.

The Investigation Division notes that all necessary technical precautions and measures were not identified and taken to depressurize the fuel oil rail before initiating the work, uncertainties exist to whether valves are effective or not.

The Investigation Division considers that it remains uncertain whether the main engine's fuel oil supply and fuel oil return lines shut off were effective.

The Investigation Division notes that the by-pass did not function effectively in terms to prevent pressure build-up in the piping system.

The Investigation Division notes that the safety valve on the intermediate rail was kept mechanically open to hinder pressure build-up, but this did not prevent pressure build-up in the piping system.

6.2 Contributory causes

The safety system

A "Safe Job Analysis" and "Permit to Work" including isolation certification had not been prepared for this particular task.

No planning in regard to safety had been made prior to initiating the work.

The Investigation Division notes that a proper risk assessment had not been carried out and the "Permit to Work system" had not been initiated for the job as required in accordance with the company's Safety Management System.

The Investigation Division considers that the lack of initiation of the company's safety procedures and lack of holding a proper tool box meeting prior to initiating the work resulted in the steam tracing was not shut off.

7 Appendixes

7.1 Similar occurrence 1

On 3 November 2008, the 4th engineer in the container ship SORØ MÆRSK noticed that the dirty water drain from the fuel oil separators was obstructed.

The drain, a 2½'' pipe, was supposed for draining water and oil from four fuel oil separators into a common dirty water tank ventilated to the atmosphere. The drain pipe was heated by steam tracing and furnished with at blind flange for opening and cleaning of the pipe.

The next day, it was decided to proceed to clean the drain pipe, a job considered ordinary and not at all dangerous.

The engineer loosened the four bolts of the blind flange, bit by bit, until nothing came out of the pipe. The draining of the pipe took about 15 minutes whereupon he was able to dismantle the flange.

Shortly after, when manipulating an obstruction in the pipe with a wire the sludge inside burst out and hit the engineer all over.

The engineer was scalded in his face, on his neck, arms, and hands, thighs, forelegs, ankles and feet.

A steam pressure had obviously been built up in the pipe which was not expected, because it was a drain pipe leading to an open tank.

It seems like there were two obstructions in the drain pipe, and in the confined space between the obstructions water and oil was heated by the steam tracing, thus creating steam pressure.

On board the ship there was no focus on the risk by working on a steam tracing heated pipe conveying water.

The ship had a safe job analysis (SJA) on computer. However, at the time of this incident, no analysis was covering work on steam heated pipes.

Work risk assessment or safe job analysis was not used on board as an active tool for mapping the risk areas in the engine room.

(The Division for Investigation of Maritime Accidents has issued a report on this occurrence. The report is available on our website www.dma.dk).

7.2 Similar occurrence 2

On 15 August 2009, the 3rd engineer in the oil and chemical tanker NORDBY MÆRSK was instructed by the ship's 2nd engineer to change the main engine's lube oil back flush filter after coffee break.

At the same time 2nd engineer closed the filter inlet to be offline without notifying 3rd engineer about this.

3rd engineer was acquainted with the job and had done it two days before.

After the coffee break, when 3rd engineer, assisted by a motorman, began the work he did not notice that the filter was already offline.

He would depressurize the filter housing by opening a drain valve and observed that the reading on the pressure gauge dropped from 6 to 0 bars. But no oil came from the drain, only air which was not normal.

Thereupon 3rd engineer unscrewed four bolts holding the filter housing. The first turns on the bolts were loosened with the usual torque, and two bolts were removed without any problems. But the third bolt was harder to remove by hand only. He insured himself that the pressure gauge showed 0 bars and proceeded loosening the bolt by using an Allen Key. After half a turn on the third bolt, warm lube oil splashed out from under the housing and hit 3rd engineer in his face, eyes and arms. 3rd engineer realized then that the filter was still online. According to his own statement he was thinking of another task and thus he did not pay attention to the actual position of the valves.

The ship was holding an SJA which, however, was not used prior to initiating the work.