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Belgium

Report 2021/000514

## Report on the investigation

into a fire

on board **TSHD UILENSPIEGEL**



in Lisnave shipyard, Portugal

with minor damage to the engine room

on January 26<sup>th</sup>, 2021.



## Extract from European Directive 2009/18

(26) Since the aim of the technical safety investigation is the prevention of marine casualties and incidents, the conclusions and the safety recommendations should in no circumstances determine liability or apportion blame.

In view of the COVID-19 pandemic in 2020, and local rules and regulations to prevent the further spread of the virus, the investigators of the Federal Bureau for the Investigation of Maritime Accidents adhered to all legislation in vigour, which might have hampered certain investigative acts. Nevertheless, no efforts were spared to conduct the investigation, into the cause of the marine accident mentioned in this report, to the largest possible extent and conclusions were only drawn after very large consideration.

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## **3. GLOSSARY OF ABBREVIATIONS AND ACRONYMS**

|      |                                     |
|------|-------------------------------------|
| AB   | Able Bodied Seaman                  |
| BFA  | Barrier Failure Analysis            |
| cbm  | Cubic Metres                        |
| IMO  | International Maritime Organization |
| kW   | kiloWatt                            |
| Lbpp | Length Between Perpendiculars       |
| LOA  | Length Over All                     |
| LT   | Local Time                          |
| m    | Metre                               |
| mT   | Metric Tons                         |
| N°   | Number                              |
| OS   | Ordinary Seaman                     |
| PS   | Portside                            |
| QHSE | Quality Health Safety Environment   |
| RCA  | Root Cause Analysis                 |
| SB   | Starboard                           |
| SMS  | Safety Management System            |
| TEU  | Twenty Foot Equivalent Unit         |
| UTC  | Universal Time Coordinated          |
| v.   | Version                             |

## **4. MARINE CASUALTY INFORMATION**

### **4.1 RESUME**

*Throughout this report all times are in Western European Time which is UTC+0, unless specified.*

On January 26<sup>th</sup>, 2021, Trail Suction Hopper Dredger UILENSPIEGEL was moored at pier 0 at Lisnave shipyard, Setubal, Portugal.

The vessel was refloated again after a period in dry dock where maintenance had been carried out, including an overhaul of the vessel's main engines.

During the running in of PS main engine, smoke appeared and fire broke out at the exhaust of PS main engine.

The engine was stopped and the fire emergency response plan was activated.

The shipboard fire team observed the situation under command of the Master and the chief engineer. The fixed fire extinguishing system was not to be activated.

When flames were no longer visible and normal operating temperatures were measured; controlled ventilation of the engine room was started.

After starting the fans and measuring of the oxygen level, the engine room was given free entrance again.

Nobody was injured during this incident and the damage was limited to some carbon deposits inside the engine room and fire damage at the exhaust of PS main engine.

## **4.2 CLASSIFICATION OF ACCIDENT**

According to Resolution A.849(20) of the IMO Assembly of November 27<sup>th</sup>, 1997, Code for the investigation of Marine Casualties and Incidents, a serious marine casualty means a marine casualty involving a fire, explosion, grounding, contact, heavy weather damage, ice damage, hull cracking suspected hull defect, etc., resulting in:

- structural damage rendering the ship unseaworthy, such as penetration of the hull underwater, immobilization of main engines, extensive accommodation damage etc.;
- or pollution (regardless of quantity);
- and/or a breakdown necessitating towage or shore assistance.

According this definition, the accident was classified as

### **SERIOUS**

## **4.3 ACCIDENT DETAILS**

|                 |   |
|-----------------|---|
| Time and date   | January 26 <sup>th</sup> , 2021, 15:15 hours LT |
| Location        | Lisnave shipyard, Setubal, Portugal             |
| Injured persons | None  |
| Damage          | Exhaust of PS main engine                       |

## 5. SYNOPSIS

### 5.1 NARRATIVE

On January 26<sup>th</sup>, 2021, TSHD UILENSPIEGEL was moored at pier 0 at Lisnave shipyard, Setubal, Portugal.

The vessel was afloat again after a period in dry dock where maintenance had been carried out, including an overhaul of the vessel's main engines.

The ship's crew had been involved in the overhaul task, together with shipyard personnel and a service engineer of MAN, the manufacturer of the main engines.

On January 26<sup>th</sup>, in the morning, the running in of the main engines commenced.

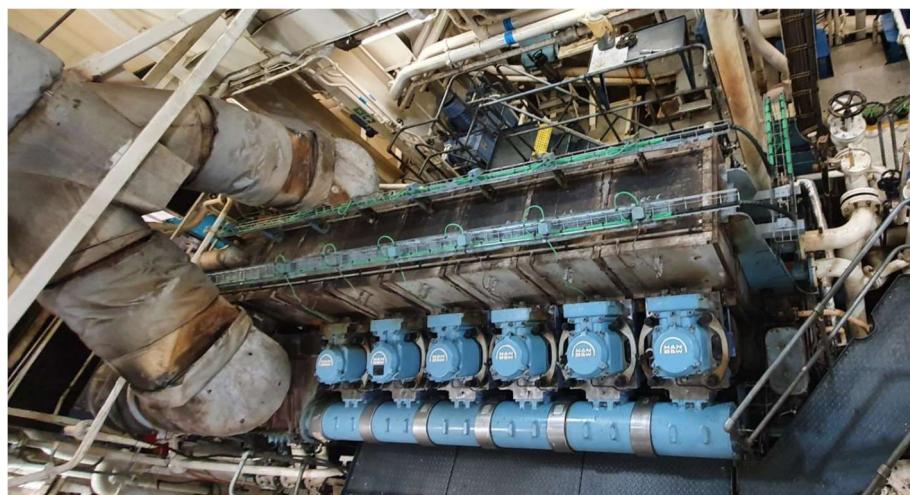


Figure 1 - PS main engine

At 12:00 hours, the running in of the main engines was stopped for a lunch break. Reportedly, nothing unusual had been observed so far.

After lunch, the running in started again and continued as foreseen.

At 15:15 hours, the PS main engine started smoking and very shortly thereafter, flames were observed at the exhaust of PS main engine in the engine room, as indicated in Figure 2.

The engine was stopped immediately.

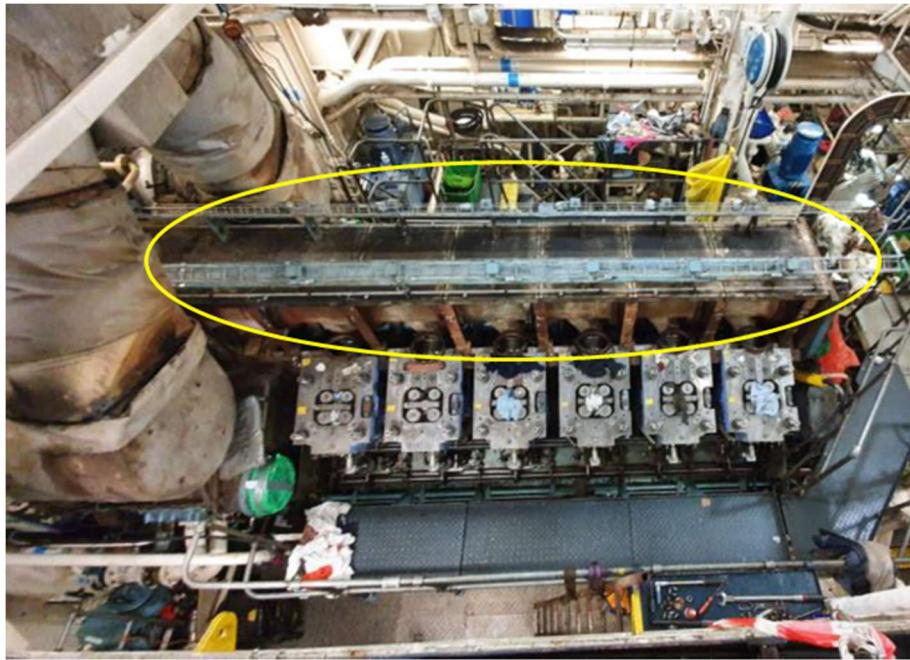


Figure 2 – Exhaust of PS main engine

*This picture was taken when the engine was not completely assembled yet. The structure in the middle, marked with a yellow circle, is the exhaust line covered with insulation panels.*

The fire alarm was activated and all crew and subcontractors assembled at the muster station. At that moment, white smoke was coming out of the funnel. Initially, one subcontractor who was working in the engine room, was missing. He was located within a minute and from that moment onward, all persons on board were accounted for. Subsequently, all ventilation of the engine room was stopped and the fire flaps were closed.

The Master instructed the shipboard fire team to gear up the firefighting equipment. The other crew was instructed to cool down the outside decks above the engine room.

Whilst the shipboard fire team was getting prepared, the shipyard fire team arrived at the muster station on the ship's main deck, waiting for further instructions from the Master.

Meanwhile, the auxiliary engine shut down due to a lack of air because the fire flaps were closed. Subsequently, the switchboards blacked out and the emergency generator kicked in and took over.

When the shipboard fire team was geared up, they proceeded through the PS passageway towards the pump room, a space adjacent to the engine room.

The fire team was accompanied by the chief engineer and the Master. By means of two-way handheld radios, communication with the ship's officers, located on deck and on the bridge, was maintained.

After arrival in the pump room, the fire team assessed the temperature of the bulwark between the pump room and the engine room. The bulwark was feeling cold.

Next, it was decided to observe the situation inside the engine room. The watertight sliding door between the pump room and the engine room was opened ajar.

Smoke was observed inside the engine room, but no flames were visible, as shown in Figure 3.



*Figure 3 - Smoke inside the engine room*

After closing the watertight door again, the Master, the chief engineer and the fire team went back to the main deck, where the Master held a debriefing regarding the situation in the engine room.

The Master communicated that the situation was under control and that no more flames were observed.

The shipyard firemen were still waiting on deck and offered their assistance, but the Master decided to keep them stand by.

After the announcement on deck, the Master, the chief engineer and the fire team went back to the pump room and prepared the BA sets for a short entry in the engine room.

After confirmation from the Master, the fire team entered the engine room for a period of less than a minute. The fire team reported that smoke was still being formed at the PS main engine. No flames were visible.

The fire team left the engine room and waited for 20 minutes. After 20 minutes, the fire team prepared for another entry and they noticed that the situation inside the engine room had not changed.

After leaving the engine room again and waiting for another 20 minutes, the fire team entered the engine room with 3 CO<sub>2</sub> fire extinguishers to cool down the exhaust line of the PS main engine, as shown in Figure 4<sup>1</sup>.

---

<sup>1</sup> Temporary cooling with a CO<sub>2</sub> fire extinguisher at a close distance is possible, as the CO<sub>2</sub> gas has a temperature of around minus 78°C when it is expelled.



*Figure 4 - Shipboard fire team equipped with CO<sub>2</sub> fire extinguishers*

*The picture was taken inside the pump room.*

After cooling down the exhaust line, the fire team left the engine room and waited for another 20 minutes.

After 20 minutes, the fire team entered the engine room to measure the temperature around the engine with a thermometer gun. The measured temperature was 156°C, being the temperature of a running engine. It was concluded that there fire had been extinguished.

The fire team left the engine room towards the adjacent pump room.

Subsequently, the ventilation of the pump room was initialised. The watertight door between the engine room and the pump room was opened together with the entrance door from the main deck towards the engine room.

The chief engineer stayed in the PS passageway to observe the situation in the engine room through the opened watertight door.

The Master went to the bridge and the fire team returned to the main deck.

During the following minutes, no changes inside the engine room were observed.

Around 17:30 hours, a new temperature check was carried out and the measured temperature was still 156°C.

Next, the ventilation was increased. The fire flaps were opened and one crew member equipped with a BA set protecting him from smoke inhalation, went to the engine control room and started up the fans.

Another crew member, also equipped with a BA set, went to the main switchboard, that was still fed by the emergency generator, to restore the power.

Once the fans were running again, the temperature was checked. The temperature had dropped to 123°C.

Thereafter, the access hatch of the hydraulic room, next to the engine room, was opened. Once the smoke in the engine room had completely disappeared; the chief engineer and the electrician entered the engine room with personal gas measurement devices.

As the gas measurement devices did not indicate any danger, the fire detection system was reset to the normal working condition and the engine room was declared safe for access.

After the fire, it was observed that insulation panel PS3 was covered with an oily substance, especially around the bolt holes. This is shown in Figure 5.



Figure 5 - Oily substance on top of insulation panel PS3

The insulation felt greasy, as indicated in Figure 6.

A small test was executed by the crew to test the flammability of the greasy insulation. When it was exposed directly to a flame, the insulation caught fire immediately and kept on burning.



*Figure 6 - The insulation felt greasy after the fire*

To test the flammability of the greasy insulation, the crew exposed a part of it directly to a flame. It was observed that the insulation caught fire immediately and kept on burning.

## 6. FACTUAL INFORMATION

### 6.1 VESSEL'S PARTICULARS



Figure 7 - TSHD UILENSPIEGEL

|                       |                                       |
|-----------------------|---------------------------------------|
| Type                  | Trail Suction Hopper Dredger          |
| Flag                  | Belgium                               |
| Port of registry      | Antwerp                               |
| Call Sign             | ORMZ                                  |
| IMO N°                | 9247467                               |
| Shipyard              | IHC Merwede & IHC Holland             |
| Year Built            | 2002                                  |
| Owner                 | Dredging International n.v            |
| LOA                   | 142,80 m                              |
| Breadth               | 26,80 m                               |
| Deadweight            | 21968 mT                              |
| Gross tonnage         | 12979                                 |
| Net tonnage           | 3893                                  |
| Main Engine           | 2x MAN B&W 4 stroke 12 cylinder       |
| Sailing output        | 11520 kW                              |
| Dredging output       | 9020 kW                               |
| Hopper Capacity       | 113700 cbm                            |
| Suction pipe diameter | 1x1200 mm                             |
| Propeller             | 2x Screw propeller controllable pitch |

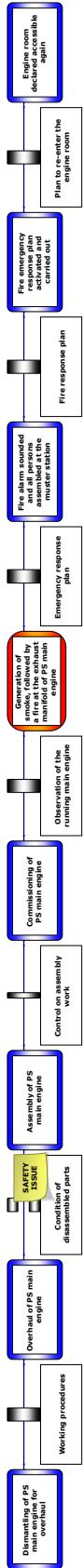
## 7. ANALYSIS

### 7.1 TIMELINE

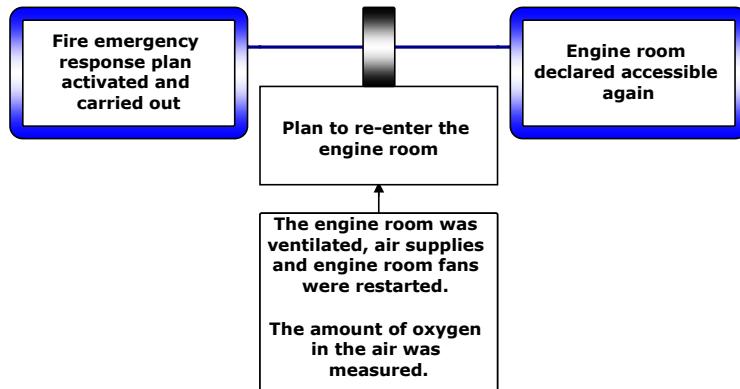
| <b>Actor</b>                                   | <b>Date and Time</b> | <b>Qualitative Date Time</b> | <b>Name</b>   |
|--|----------------------|------------------------------|---|
| <b>Crew</b>                                    | 26-jan-2021          | Before fire                  | Commissioning of PS and SB main engine after overhaul in dry-dock the days before   |
| <b>Crew</b>                                    | 26-jan-2021 12:00    | Before fire                  | Running in stopped at noon for lunch  |
| <b>Crew</b>                                    | 26-jan-2021 15:00    | FIRE BROKE OUT               | PS engine running in and white smoke was generated  |
| <b>Chief Engineer</b>                          | 26-jan-2021 15:15    |                              | Chief engineer announced fire in the engine room at the exhaust of PS main engine   |
| <b>Crew</b>                                    | 26-jan-2021 15:15    |                              | PS main engine stopped  |
| <b>Crew</b>                                    | 26-jan-2021 15:15    |                              | Fire alarm sounded  |
| <b>Crew</b>                                    | 26-jan-2021 15:15    |                              | Crew assembled at the muster point  |
| <b>Shipyard personnel &amp; Subcontractors</b> | 26-jan-2021 15:15    |                              | Subcontractors assembled at the muster point, one person was missing  |
| <b>Shipyard personnel &amp; Subcontractors</b> | 26-jan-2021          | + 1 minute                   | Missing person located  |
| <b>Crew</b>                                    | 26-jan-2021          |                              | All crew and subcontractors accounted for   |
| <b>Master</b>                                  | 26-jan-2021          |                              | Master ordered to stop ventilation and to close all fire flaps  |
| <b>Crew</b>                                    | 26-jan-2021          |                              | Crew witnessed white smoke coming out of the funnel   |
| <b>Master</b>                                  | 26-jan-2021          |                              | Master had the ship's fire team geared up   |
| <b>Shipyard personnel &amp; Subcontractors</b> | 26-jan-2021          |                              | Shipyard fire team arrived at the muster point on board   |
| <b>Master</b>                                  | 26-jan-2021          |                              | Master ordered boundary cooling of the decks above the engine room department   |
| <b>Crew</b>                                    | 26-jan-2021          |                              | Switchboards blacked out due to malfunctioning of the auxiliary generator caused by a lack of air as the fire flaps were closed. The emergency generator took automatically over. |
| <b>Ship's fire team</b>                        | 26-jan-2021          |                              | Fire teams went to the pumproom adjacent to the engine room   |
| <b>Crew</b>                                    | 26-jan-2021          |                              | The bulkhead between the pumproom and the engine room was assessed to be cold   |
| <b>Ship's fire team</b>                        | 26-jan-2021          |                              | The watertight sliding door was slightly opened and only smoke was observed, no flames  |
| <b>Shipyard personnel &amp; Subcontractors</b> | 26-jan-2021          |                              | Shipyard fire team was kept stand -by   |
| <b>Master</b>                                  | 26-jan-2021          |                              | Master briefed all persons on deck that the fire was under control and no flames were observed anymore  |
| <b>Master</b>                                  | 26-jan-2021          |                              | Master decided to proceed with ship's fire team   |
| <b>Ship's fire team</b>                        | 26-jan-2021          |                              | First fire team went inside with BA, less than one minute. Smoke was still commencing   |
| <b>Ship's fire team</b>                        | 26-jan-2021          | + 20 minutes                 | Fire team went back in, same situation.   |

|                         |             |                |   |
|-------------------------|-------------|----------------|---|
| <b>Ship's fire team</b> | 26-jan-2021 | + 20 minutes   | Fire team went back in with 3x Co2 extinguisher to cool down the exhaust of the PS engine where the flames were initially observed                                      |
| <b>Ship's fire team</b> | 26-jan-2021 | + 20 minutes   | Fire team went back in with heat gun, a temperature of 156°C was measured, the normal operational temperature   |
| <b>Master</b>           | 26-jan-2021 |                | The Master went back to the bridge  |
| <b>Chief Engineer</b>   | 26-jan-2021 |                | Chief engineer took over on scene command   |
| <b>Ship's fire team</b> | 26-jan-2021 |                | Fire team left the sliding door between pump room and engine room open for ventilation. Fire team was kept stand-by in the PS passageway                                |
| <b>Crew</b>             | 26-jan-2021 |                | The access door to the engine room on main deck was opened for ventilation  |
| <b>Ship's fire team</b> | 26-jan-2021 |                | Fire team entered the engine room again for temperature check. Temperature of the engine was 156°C  |
| <b>Crew</b>             | 26-jan-2021 |                | Fire flaps opened for ventilation of engine room  |
| <b>Crew</b>             | 26-jan-2021 |                | One person with BA went to the control room to switch on the fans. Another person with BA went to the main switchboard fed by the emergency generator to power on again |
| <b>Ship's fire team</b> | 26-jan-2021 |                | Temperature measured 123°C  |
| <b>Crew</b>             | 26-jan-2021 |                | Hydraulic room hatch was opened for ventilation   |
| <b>Chief Engineer</b>   | 26-jan-2021 |                | The air in the engine room was clear again and the chief engineer and electrician went inside the engine room with personal oxygen metres                               |
| <b>Crew</b>             | 26-jan-2021 |                | Additional fan was started and fire detection system was reset. No more alarms were initialized   |
| <b>Master</b>           | 26-jan-2021 |                | The engine room was declared accessible   |
| <b>Chief Engineer</b>   | 26-jan-2021 | After incident | The insulation of PS main engine was found soaked with oil  |

## 7.2 BARRIER FAILURE ANALYSES DIAGRAM (BFA)

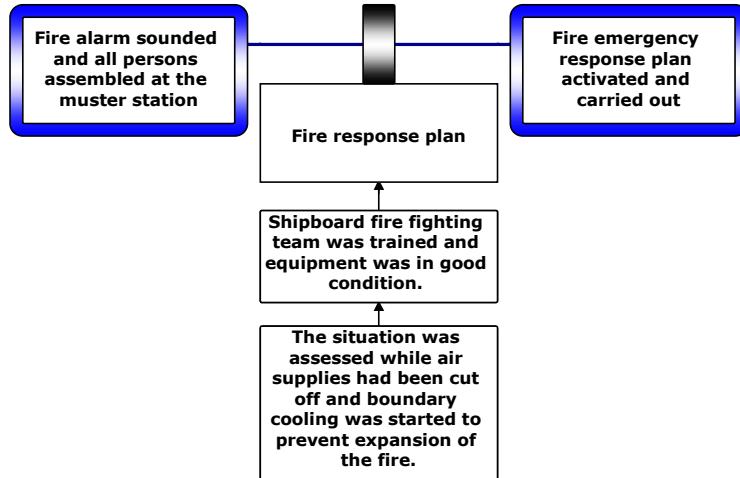


### 7.3 INCIDENT TREE CUT-UP



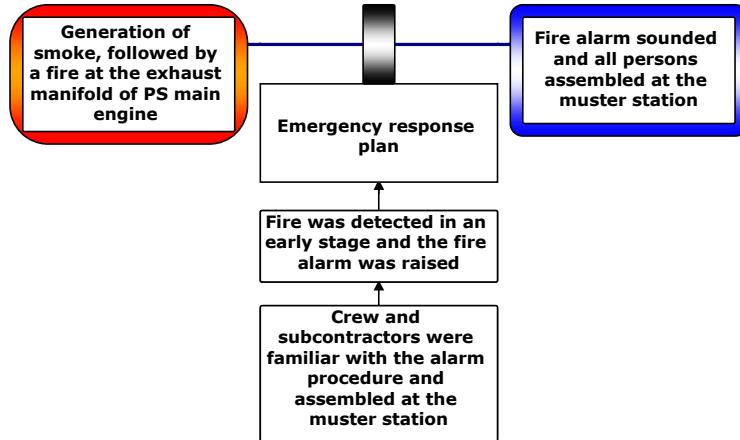
*Engine room declared accessible again*

| Incident<br>Barrier<br>Effective | Performance        | Barrier Challenge | Remarks regarding performance  |
|----------------------------------|--------------------|-------------------|--|
| Plan to re-enter the engine room | BFA Primary Causes | Safety procedure  | <p>The engine room was ventilated, air supplies and engine room fans were restarted.</p> <p>The amount of oxygen in the air was measured</p> |



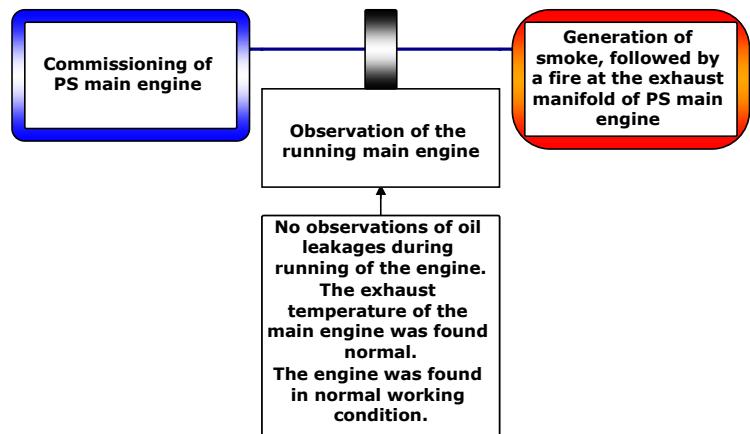
#### *Fire emergency response plan activated and carried out*

| <b>Incident Barrier Effective</b> | <i>Performance</i>   | <i>Barrier Challenge</i> | <i>Remarks regarding performance</i>  |
|-----------------------------------|----------------------|--------------------------|---|
| Fire response plan                | BFA Primary Causes   | Training and drills      | Shipboard fire team was trained and equipment was in good condition.  |
|                                   | BFA Secondary Causes | Safety procedure         | The situation was assessed while air supplies had been cut off and boundary cooling was started to prevent expansion of the fire. |



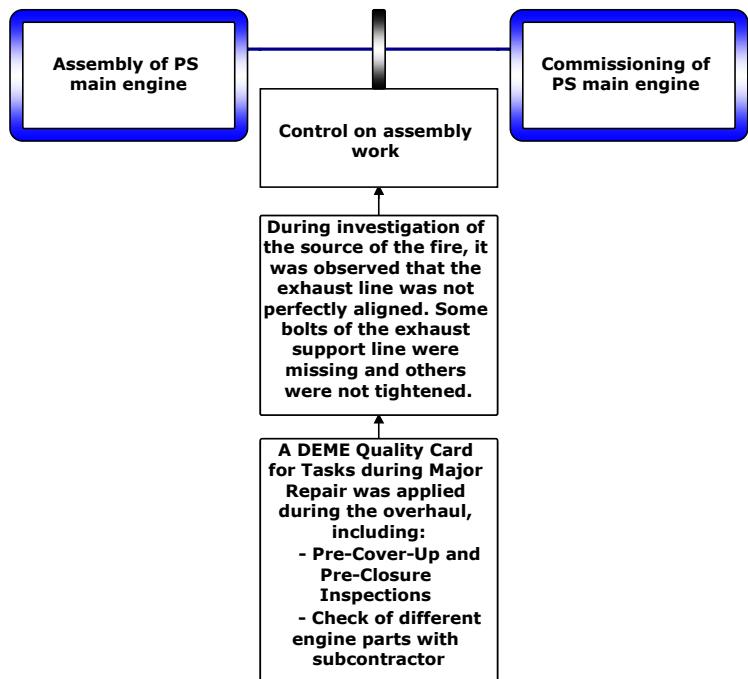
*Fire alarm sounded and all persons assembled at the muster station*

| <b>Incident Barrier Effective</b> | <i>Performance</i>   | <i>Barrier Challenge</i> | <i>Remarks regarding performance</i>   |
|-----------------------------------|----------------------|--------------------------|--|
| Emergency response plan           | BFA Primary Causes   | Safety procedure         | Fire was detected in an early stage and the fire alarm was raised                                  |
|                                   | BFA Secondary Causes | Familiarization          | Crew and subcontractors were familiar with the alarm procedure and assembled at the muster station |



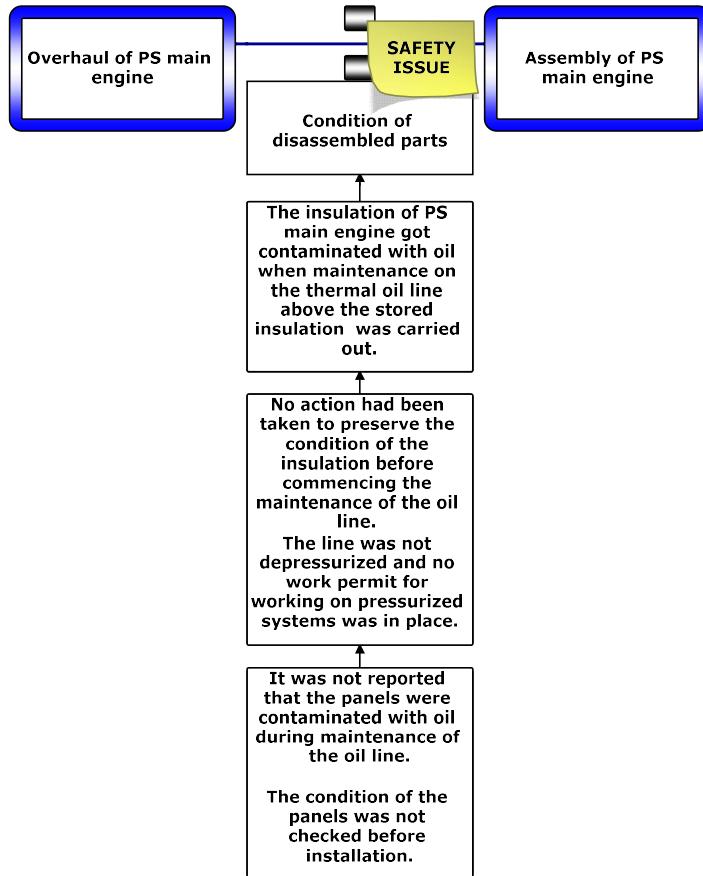
#### *Generation of smoke, followed by a fire at the exhaust manifold of PS main engine*

| <b>Incident Barrier Effective</b> | <i>Performance</i> | <i>Barrier Challenge</i> | <i>Remarks regarding performance</i>   |
|-----------------------------------|--------------------|--------------------------|--|
| Condition of the main engine      | BFA Primary Causes | Quality control          | No observations of oil leakages on insulation during running of the engine.<br>The exhaust temperature of the main engine was found normal.<br>The engine was in normal working condition.<br>No oil residues were detected in the exhaust line. |



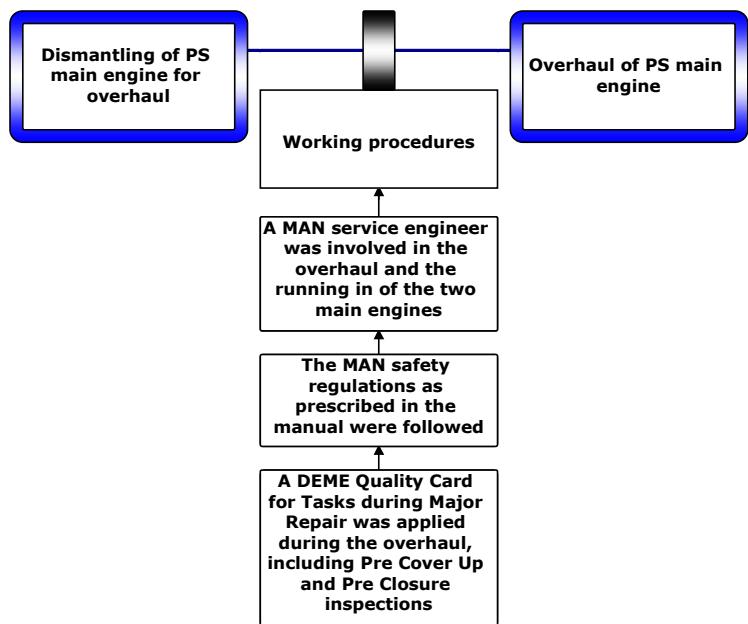
### *Commissioning of PS main engine*

| <b>Incident Barrier<br/>Unreliable</b> | <i>Performance</i>   | <i>Barrier Challenge</i> | <i>Remarks regarding performance</i>  |
|--|----------------------|--------------------------|---|
| Control on assembly work               | BFA Primary Causes   | Operational control      | During investigation of the source of the fire, it was observed that the exhaust line was not perfectly aligned. Some bolts of the exhaust support line were missing and others were not tightened. |
|  | BFA Secondary Causes | Operational procedures   | A DEME Quality Card for Tasks during Major Repair was applied during the overhaul, including:<br>- Pre-Cover-Up and Pre-Closure Inspections<br>- Check of different engine parts with subcontractor |



### Assembly of PS main engine

| <b>Incident Barrier Failed</b>  | <b>Performance</b>   | <b>Barrier Challenge</b> | <i>Remarks regarding performance</i>  |
|---------------------------------|----------------------|--------------------------|---|
| Condition of disassembled parts | BFA Primary Causes   | Work preparation         | The insulation of PS main engine got contaminated with oil when maintenance on the thermal oil line above the stored insulation was carried out.  |
|                                 | BFA Secondary Causes | Planning and preparation | No action had been taken to preserve the condition of the insulation before commencing the maintenance of the oil line.<br>The line was not depressurized and no work permit for working on pressurized systems was in place. |
|                                 | BFA Tertiary Causes  | Communication            | It was not communicated that the panels were contaminated with oil during maintenance of the oil line.<br>The condition of the panels was not checked before installation.  |



### *Overhaul of PS main engine*

| <b>Incident Barrier<br/>Effective</b>    | <b>Performance</b>      | <b>Barrier<br/>Challenge</b>     | <i>Remarks regarding performance</i>   |
|--|-------------------------|----------------------------------|--|
| Preservation of<br>disassembled<br>parts | BFA Primary<br>Causes   | Working<br>with third<br>parties | A MAN service engineer was involved<br>in the overhaul and the running in of<br>the two main engines   |
|  | BFA Secondary<br>Causes | Safety<br>procedures             | The MAN safety regulations as<br>prescribed in the manual were<br>followed   |
|  | BFA Tertiary<br>Causes  | Operational<br>procedures        | A DEME Quality Card for Tasks<br>during Major Repair was applied<br>during the overhaul, including Pre<br>Cover Up and Pre Closure inspections |

## **8. CAUSE OF THE ACCIDENT**

The fire was caused because insulation panels contaminated with oil were installed during the re-assembly of the main engine.

Insufficient control measures were in place to verify the condition of the insulation before installation.

The oil ignited when the temperature in the exhaust line increased during the running in of the engine.

The contamination with oil happened when the insulation was stored unprotected under a thermal oil line.

During maintenance of the oil line, an oil spill occurred and contaminated the insulation.

The maintenance on the thermal oil line was not properly prepared and thus contributed to the accident.

It was not communicated that the spilled oil had contaminated the insulation panels.

The lack of communication about the spilled oil is also considered as a contributing factor to the incident.

## **9. SAFETY ISSUES**

The communication between the ship's personnel and personnel of the shipyard was insufficient and not all operational procedures as prescribed by the vessel's management system were followed by the personnel of the shipyard:

- During maintenance of a thermal oil line by personnel of the shipyard, oil was spilled, and the panels were contaminated with the spilled oil. The maintenance of the thermal oil line was not scheduled for the day it was executed.

The required "Permit to work on pressurized systems" when working on a system that is under pressure during normal operations was not available.

- No action had been taken to preserve the condition of the insulation before commencing the maintenance of the oil line.

It was not reported that the panels were contaminated during the spill.

- During the assembly of the engine, the contaminated insulation panels were installed at the exhaust line by personnel of the shipyard.

The condition of the panels had not been reported before or during installation.

## **10. ACTIONS TAKEN**

A Root Cause Analysis, RCA, was made by the company, involving personnel from the vessel's team, including the chief engineer, personnel from the technical support team and personnel from the QHSE department.

The RCA resulted in following safety improvements:

**1. The communication between yard, service engineers, crew and docking team should be improved:**

- All jobs that are planned during the day, need to be discussed during the daily meeting;
- Tracks of minutes of meetings have to be signed by parties involved;
- Prior to start a job, a work permit needs to be issued and to be signed by the yard and the owners representative(s);
- Prior to start any job on board, the crew needs to be informed;
- After an incident, take the time and go on the spot with all people involved to assess the complete damage in detail.

**2. The condition of the insulation should be checked (if possible) prior to re-installing:**

- The inspection of the condition of the exhaust insulation before reinstallation had been added to the company's quality card for tasks during the overhaul of a main engine.

**3. Care has to be taken of proper storage & protection of disassembled equipment (e.g. insulation) and store it away from the working area.**

**4. Improve the work preparation:**

- Stick to the planning of the day discussed during the daily meetings with different stakeholders.
- Shipyard supervisors need to be on the spot during the start-up of the job and regular inspections are needed during the execution of the job.

The results of the RCA were discussed and distributed among all vessel managers, which are engaged in major repairs.

The RCA was also distributed to higher management and to QHSE & Marine Operations department.

A summary of the RCA will form part of the info shared in the 6 monthly Technical Department Maintenance newsflash.





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