The Swedish Club

Loss Prevention Supplement

Dealing with engine room fires

Introduction

By **Peter Stålberg**
Senior Technical Advisor

Over the last 10 years, between 2008 and 2017, The Swedish Club received 28 reports concerning engine room fires. When compared to other Hull and Machinery (H&M) claims the frequency of engine room fires is low but the average cost is among the highest - USD 1,850,000 per occurrence - compared with USD 320,000 for H&M claims in general.

Engine rooms on ships have all the ingredients for a fire – oxygen, heat and flammable liquids under pressure. Not surprisingly, one of the dominating causes is lube-oil or fuel-oil mist spraying onto hot surfaces and then igniting

Prevention

Peter Stålberg, Senior Technical Advisor at The Swedish Club, explains: "The SOLAS requirements concerning oil piping in engine rooms are clear; all types of oil pipes must be screened and flanges protected so that any eventual leak will not spray onto a hot surface. Any surface with a temperature above 220°C must be thermally insulated."

All vessels today are required to have double containment piping (jacketing) for high pressure oil piping. Any leakage inside the containment will be lead to a small collecting tank thus giving the operator early warning of a problem. Any other fuel piping should be screened.

At new build the insulation of the exhaust pipe system - including the turbo-chargers - is normally in good

About Peter Stålberg

Peter Stålberg returned to The Swedish Club as Senior Technical Advisor, two years ago, after spending nine years working in the offshore sector.

Prior to that he previously worked for the Club from 1993 to 2008 in various roles including Technical Manager, Staff Surveyor, Director Technical and Risk Assessment, and Area Manager.

With an expertise in marine engineering and risk assessment, Peter's priorities are to ensure efficiency in the way the Club works, and to make sure that the Loss Prevention team maintains focus on the key issues affecting shipping today.

condition. "Over time, however, when overhauling engine room machinery and removing/refitting exhaust pipes, the insulation will deteriorate," explains Stålberg. "An exhaust pipe system insulated to 95% is not good enough – it must be 100% intact – always."

Poorly insulated exhaust pipe

Dealing with an engine room fire

Preventing an engine room fire is the priority, but the time and effectiveness of the response is almost as important. Although a crew has taken all reasonable precautions, an engine room fire can still occur without warning.

"In one case I was involved with," says Stålberg, "even though the exhaust gas pipes on the vessel were insulated with thick blankets of insulation and covered with metal sheets, spraying oil from a sheared hydraulic oil pipe, which found its way to the hot exhaust gas pipe under the insulation, through the crevices and ignited. Quick action by the crew controlled the fire and minimised the damage.

Preventing an engine room fire is the priority, but the time and effectiveness of the response is almost as important

"A swift and effective response within a few minutes may limit the damage, to soot washing and less than USD 200,000 in costs. Yet I have seen cases where delaying the response or failing to operate the fire extinguishing system properly, has allowed the fire to intensify and spread, causing severe damage and cost in excess of USD 3,000,000.

"In the following articles we take a look at three different engine room fires – could they have been avoided? Were they dealt with properly? And could they happen on your ship?"

Fires may happen with very low frequency when compared with other types of damage, but the consequences can be severe.

The PSV Brann

Interview with **Angelo Santos** Chief Engineer of the Platform Supply Vessel Brann

"We were heading for an offshore unit to discharge cargo. The weather was not good - the wind speed was about 30 knots with a swell of about 4 metres – but we were all experienced and knew what we were doing.

I was told later that at about 1850 the fire alarm had sounded on the bridge, and the Master, who was on the bridge at the time, saw smoke coming from the funnel ventilation on the port side. He immediately set off the general alarm.

Meanwhile I was in the engine control room when the fire alarm sounded and so I left the room to see what was happening. There was a fire around the top covers of cylinders #2/#3 of the port side main engine.

I tried to put out the fire with a portable fire extinguisher, but it was too bad and so I went back to the engine control room, activated the fire alarm button and contacted the Master on the bridge.

Other members of the crew came to assist and we tried to enter the engine room again to put out the fire, but the flames were very high with a great deal of smoke and so we could not get near it. We decided it was time to release the CO_2 bottles of the fixed system and flood the engine room.

I closed all the fire dampers and activated the remote quick closing valves for the fuel system. I then went into the CO_2 fixed system release station with the electrical engineer. We opened the cabinet door and automatically the CO_2 release alarm sounded and the ventilation fans stopped. We then started on the steps needed to perform the CO_2 release.

However, whilst we were going through this process I must have missed opening one of the valves and no CO_2 was released. As soon as I realised this I used the manual handle to open the CO_2 bottles. Unfortunately I found out later that only seven CO_2 bottles from a total of thirteen were released into the engine room.

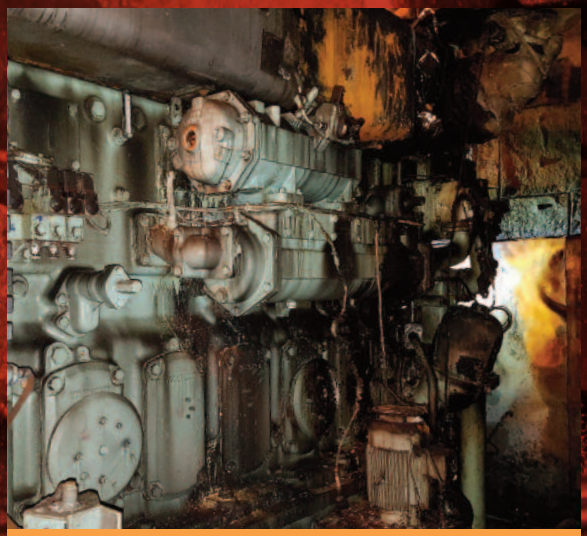
After releasing the CO_2, we were pleased to see that the amount of smoke coming from the engine room through the funnel ventilation was decreasing. However very soon the amount of smoke increased again.

At this point we realised that the CO_2 system had not worked as we had hoped and that we had to abandon the vessel. We launched the two starboard side life rafts and one of the port side life rafts, but found that we couldn't abandon ship on that side because the weather was too bad and it was not safe. Two members of the crew managed to get into the first starboard life raft when the safety line broke. The other fourteen of us made it into the second life raft.

Luckily we were all rescued within 20 minutes of abandoning the Brann."

The cost of the casualty was USD 2,400,000.

It really is all about training, to ensure that the crew can respond – they are the last barrier.



Cause

The fire was triggered by a diesel oil leak from the port side engine coming into contact with the hot metal of the engine. This leak was caused by a broken pipe from the return line of cylinder fuel pump no. 3 of the port side main engine.

Further investigation showed that the emergency quick closing valves were not properly shut when remotely activated by the Chief Engineer at the time of the casualty.

Viewpoint: Peter Stålberg

This was a disaster. While the root cause of the damage, i.e. the broken pipe, may be difficult to establish, it's clear that the response from the crew was one of confusion and mistakes.

They saw the fire and tried to put it out, but the flames were high and that didn't work. So they shut the quick-closing valves and went to release the CO_2, but half of the CO_2 was not released, so there was not enough to completely extinguish the fire. If a fire like that doesn't die out immediately, the oxygen will come back in and it will start burning again.

Were the crew properly trained and familiar with the onboard systems? It really is all about training, to ensure that the crew can respond – they are the last barrier. We have so many other barriers, including double-skinned pipes, insulation of hot surfaces, detection systems, automatic shutdowns, but when a fire breaks out it is up to the individual to handle it. So it's therefore vital to ensure that the crew is trained in the firefighting system on the ship, and that the system is in very good condition.

Another issue this case highlights is the way in which fire drills are carried out. We find that many fire drills are carried out on deck, when it would be more realistic and relevant to stage nine out of ten fire drills in the engine room, because that is where fires generally start.

Despite having to abandon the ship in such difficult weather conditions, all of the crew were rescued safely. They were lucky that there were other ships around – otherwise lives might have been lost, not because of the fire itself, but because of the need to abandon the ship.

Once again, we must emphasise - training is the mother of all knowledge. Fires may happen with very low frequency when compared with other types of damage, but the consequences can be severe. The crew's response time is really critical. Delay the response by ten minutes and the repairs costs can be tenfold. Even if you run a tight ship, a fire may occur – and you must be prepared.

The MV Vatria

Interview with
Captain Sven Carlsblad
Master of the Container Vessel Vatria

"We were en route to Salalah. All evening I had been receiving reports of alarms being activated due to high levels in some of the fuel leakage collecting tanks.

The first alarm went off at 1630 followed by a second alarm ten minutes later. Shortly afterwards the first alarm went off again twice. After this it did not return to normal status.

At 2320 my Chief Engineer reported an automatic slowdown of the main engine. At the same time I saw heavy smoke coming into the bridge from the funnel area. This was caused by a fire in the engine room. The fire alarms were activated followed by an automatic shutdown of the main engine and engine room ventilation fans.

At 2330 I mustered the crew and all were found present with no injuries. The Chief Engineer went into the fire station and shut the quick closing valves and released CO_2 into the engine room. He then cut off electrical power in the engine room and closed the skylight and all ventilation flaps.

At that point we sent an undesignated distress relay via INM C and MF-HF giving the location position of the Vatria, and I contacted our Company DPA (Designated Person Ashore).

The crew rigged the fire hoses and began cooling the boundary and monitoring temperatures in the engine room. The VDR incident back up was activated and we carried on cooling the boundary and keeping in touch with the manager's emergency team.

When the temperature had gone down from 52°C to 41°C my Chief Officer led the firefighting team to the engine room skylight where they could see that the fire had been extinguished. As no fire was visible they thought it safe to go into the engine room through the aft emergency exit. The team then came out of the engine room and confirmed that the fire had been put out, at which point the hoses were turned off.

We restarted the engine room ventilation at 1418 and the firefighting team used gas detectors to sample the engine room atmosphere – they declared it safe with no more fire hazard.

Following this we restarted the two auxiliary engines and restored partial power in the engine room. Electrical power was restored to all the reefer containers and I sent the crew to manually monitor reefer temperatures.

We were without main engine power for six days until a tug arrived to tow us to port."

The intensity of the fire caused significant smoke, heat and fire damage to the engine room and the equipment within it. The insurance claim was in the region of USD 3,500,000.

Cause

The survey concluded that the main cause of the fire in the engine was related to the failure of the aft fuel oil high pressure pipe of unit No. 4. The pipe had fractured and severed completely at the thrust bushing at the fuel pump side.

According to the information provided by the ship's staff it is unknown if the correct tightening pressure of 190 Nm was applied as recommended in the MAN service instruction manual.

Viewpoint: Peter Stålberg

Looking at the events leading up to this fire we can see that the first alarm went off at 1630 and there was a series of alarms after that – but the crew didn't do anything and apparently didn't understand what was going on. They were given hours of pre-notice to deal with the situation but they ignored it. A few hours after the first alarm, the connection burst, there was a huge spray of fuel, and fire broke out.

This case is interesting because there are a lot of alarms that can go off for various reasons, to help the engineer protect a ship's technical equipment. You must have your alarm system in order, you must understand what the different alarms are for, and you should never have the attitude of 'that alarm's always going off', and just ignoring it.

IMO regulations stipulate that all high-pressure fuel piping must be double-skinned so that if the pipe starts leaking, the spray will be contained between the outer skin and the pipe. The fluid is collected into a small tank with a high-level alarm – when that alarm goes off, you know you have a leakage of high-pressure fuel, and you should investigate and take action promptly.

This started as a small leak contained within the double skin. The crew had the possibility of averting a fire, if they had responded properly to the alarm.

Once the fire had broken out, the response was good. The crew were mustered within ten minutes, and the fire was promptly extinguished with CO_2.

However, in releasing the CO_2 into the engine room, the Chief Engineer did some things in the wrong order. The quick-closing valves were shut correctly but the skylight and all ventilation flaps should also have been closed before the CO_2 was released – otherwise there is a risk that the CO_2 could be ventilated out.

The MV Fuoco

Interview with **Franco Pueblo** Chief Engineer of the Bulk Carrier Fuoco

"We were on a ballast passage to Durban, South Africa and crossing a high pirate risk area. The No. 2 auxiliary engine was in operation and providing our electrical power requirements with the No. 3 auxiliary engine acting as the standby.

At 0845 hours we lost all electrical power, followed by the main engine shutting down. Our emergency generator started automatically, and at the same time the 'fire in engine room' alarm started, followed by the general alarm and other engine room alarms.

I hurried to the engine room where I saw smoke and fire coming from the auxiliary generator platform on the third deck level. The engine room team said that the No.2 auxiliary engine had caught fire – this was quickly spreading and they couldn't control it. They had tried to put out the fire by using portable fire extinguishers, but without any luck.

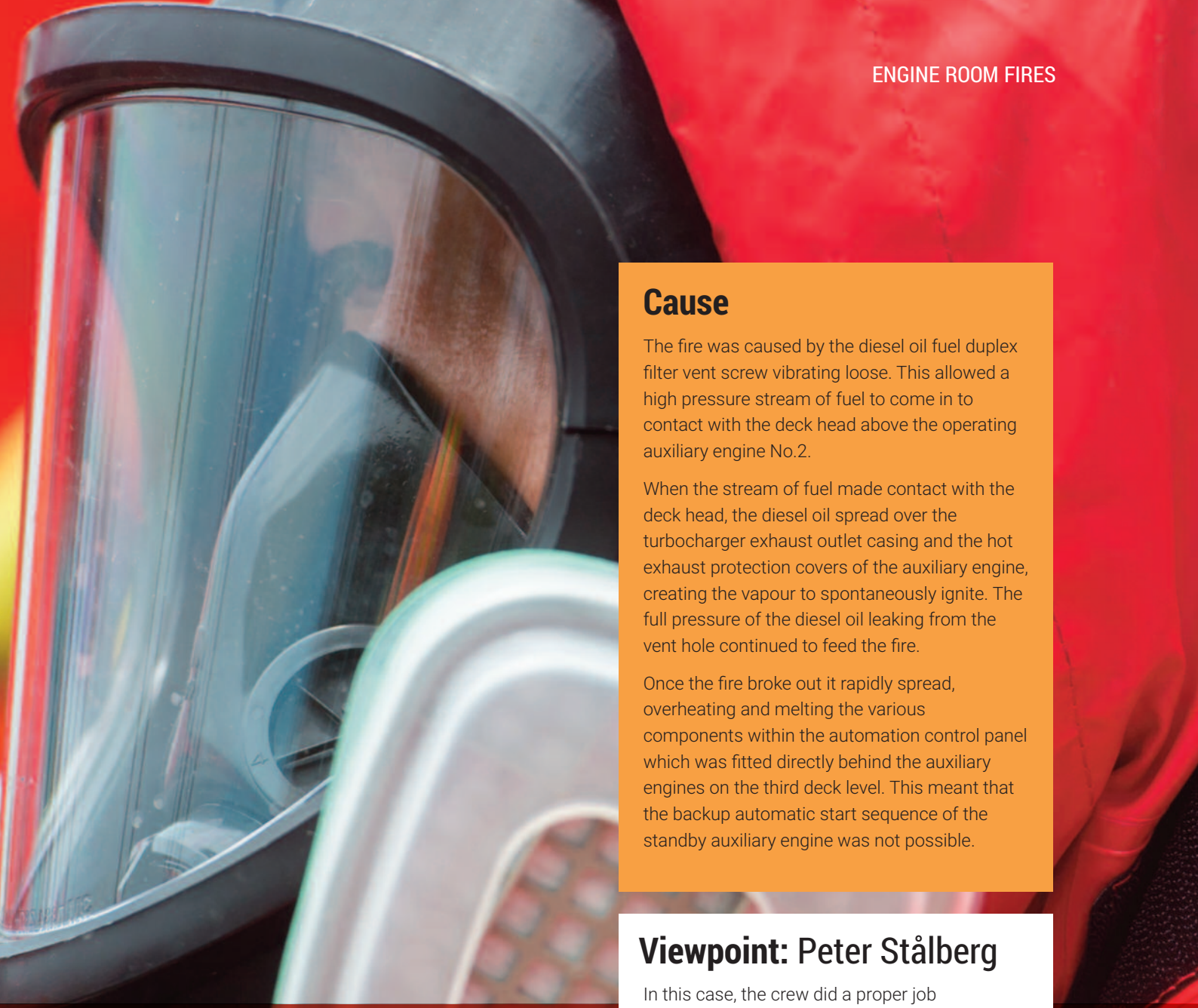
I grabbed a portable CO_2 fire extinguisher but couldn't get near the auxiliary engine platform due to the intense heat, flames and smoke. In the end we were forced to evacuate the engine room.

Immediately we mustered the crew and were relieved to find nobody missing and no casualties.

I then went with the Master to the remote control station outside of the engine room, and we activated the fuel oil quick closing valves, closed the fire dampers and stopped the engine room ventilation fans. At 0900 exactly we set off the engine room's CO_2 fire extinguishing system which released the contents of one hundred and one cylinders of CO_2 into the engine room. 30 minutes later the emergency firefighting team went into the engine room from the upper deck entrance and reported that the fire had been extinguished.

We checked the fire damaged area when it was safe to do so, and the engine room was declared all clear. We restored ventilation at 0950 hours and at 1040 hours the engine room was manned."

The insurance claim was in the region of USD 450,000.



Cause

The fire was caused by the diesel oil fuel duplex filter vent screw vibrating loose. This allowed a high pressure stream of fuel to come in to contact with the deck head above the operating auxiliary engine No.2.

When the stream of fuel made contact with the deck head, the diesel oil spread over the turbocharger exhaust outlet casing and the hot exhaust protection covers of the auxiliary engine, creating the vapour to spontaneously ignite. The full pressure of the diesel oil leaking from the vent hole continued to feed the fire.

Once the fire broke out it rapidly spread, overheating and melting the various components within the automation control panel which was fitted directly behind the auxiliary engines on the third deck level. This meant that the backup automatic start sequence of the standby auxiliary engine was not possible.

This was a good response. The crew were trained and they knew how to deal with the situation.

Viewpoint: Peter Stålberg

In this case, the crew did a proper job extinguishing the fire. They managed to release the contents of all 101 CO_2 cylinders into the engine room; 30 minutes later the team went into the engine room, and the situation was under control.

This was a good response. The crew were trained and they knew how to deal with the situation. It's important to remember that even if you follow all the rules and regulations, you can still have fires – you can't foresee everything – and that is why training is so necessary.

As to the cause, we have seen similar cases where a vent screw or sampling point has vibrated open. It could be that when someone has changed filters or taken samples, they quickly fastened the screw by hand and forgot to tighten it properly later. This would be the result of a poor maintenance routine – a checklist would have eliminated this hazard.

LOSS PREVENTION ESSENTIALS

How to avoid engine room fires

- Ensure that the insulation covering heated surfaces is always in good condition.
- Use thermal imaging at regular intervals to spot and identify inadequate insulation and hot surfaces.
- Routinely check and inspect pipe work and screening arrangements for deterioration.
- Any leakage found should be investigated and dealt with immediately.
- No woodwork, combustible material or flammable compounds should be stored in machinery spaces.
- Ensure by regular testing that passive safety devices such as fire dampers and quick closing valves are in good condition and fully operational.
- Make sure the engine alarm system is fully functional. Always investigate alarms thoroughly and take prompt action before clearing the alarm status.
- Get to know your fixed fire fighting system. Have the system serviced at regular intervals by a manufacturer's specialist and make sure that release instructions are clear and correct.
- Focus your fire drills in machinery spaces. Training is the key to a successful response.
- The response time is crucial for the outcome. Respond immediately as soon as you detect a fire.

Loss prevention

Loss prevention is at the heart of everything we do

It saves lives
It protects the environment
It delivers onboard efficiencies

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Loss Prevention Officer

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Our goal is to contribute to an enhanced marine safety culture and we know that being a step ahead is paramount when it comes to preventing accidents. The Swedish Club puts a great deal of effort into loss prevention analysis and knowledge-sharing with its members and the shipping community.

We learn from incidents that have taken place, and endeavour to prevent them reoccurring by working with our members to offer them guidance and training initiatives:

Training

- Emergency Response Training
- Stress Test Drill
- Monthly Safety Scenario
- Maritime Resource Management (MRM)

Initiatives

- The Swedish Club Philippine Pre Engagement Medical Examination (PEME)
- Swedish Club Operations Review (SCORE)
- Benchmarking
- Awareness campaigns

Information

- Member Alerts
- Loss prevention publications
- Loss prevention guidance

Our complete portfolio of loss prevention solutions can be found at:
www.swedishclub.com/loss-prevention