# Case study for onboard safety meeting

## Use of fixed carbon dioxide fire extinguishing systems

The use of vessels' fire-fighting equipment can have its limitations. A report issued by the UK MAIB following an engine room fire, highlights how important it is that the crew fully understands the functionality of and limitations associated with use of the vessel's fixed fire extinguishing system to provide timely and effective emergency response during a fire. This case study is based on the incident report issued by the UK MAIB.

The vessel was on a voyage in a busy traffic lane some 20 nm from its destination when a fire was detected in the engine room. Shortly thereafter, the vessel suffered a blackout. The vessel's propulsion and power generation plant consisted of a main engine coupled to a shaft generator, two auxiliary generators and an emergency generator. At the time of the fire, the vessel's electrical power was supplied by the shaft generator. However, shortly after the blackout, one of the auxiliary generators cut in and restored the electrical power onboard the vessel.

The chief engineer decided to enter the engine room immediately to establish the location and source of the fire. Upon entering, he noticed that smoke had started to fill the room but was still able to identify the approximate location of the fire and report this to the bridge. The master sounded the fire alarm and made a PA announcement ordering the evacuation of the engine room. Once all personnel were accounted for, the engine room ventilation system was shut down, all doors and openings were closed and the fixed carbon dioxide ($CO_2$) fire extinguishing system activated. The engine room was kept isolated for approximately an hour. However, during this time the master decided to keep the main engines and the auxiliary generator running at slow speed to keep the vessel on its course.

After an hour, ventilation to the engine room was resumed and the vessel's fire-fighting team entered the space to look for hot spots. The fire-fighters reported that the fire was not fully extinguished and dowsed the remaining fire using the firehoses and portable fire extinguishers located in the area.

On arrival at the destination port, the local fire department inspected the engine room and confirmed that the fire was completely extinguished. The seat of the fire was found to be a rubber coupling located between the main engine and the shaft generator that may have caught fire due to overheating.

The investigators from the local fire department suggested that while the activation of the $CO_2$ system was a prudent action by the vessel's crew, the decision to continue running the machinery and maintain main engines at slow speed was not. This because the extinguishing capabilities of gases can be compromised if the integrity and tightness of the boundaries of the protected space are not sound. Fixed gas fire extinguishing systems, such as the $CO_2$ systems on board this vessel, therefore require a complete shutdown of the engine room to ensure the desired effect when fighting a fire. As the vessel's main propulsion system and auxiliary generators take air from within the engine room, a significant amount of $CO_2$ was consumed by the machinery; thereby reducing the effectiveness of the fire extinguishing system. Furthermore, the decision to continue to run the engines could also have damaged the propulsion system due to lack of oxygen for internal combustion.

# How to improve by lessons learnt

Based on the case and the keywords below, you should now perform an onboard risk assessment of the incident and the factors which led to it. Bear in mind the company's SMS procedures when answering the questions.

Please also discuss the following questions to increase awareness;

- Are senior officers on board aware of any limitations of the $CO_2$ system on board the vessel?
- Does the vessel's SMS cover the necessity of stopping the main engine and other machinery completely when activating the fixed $CO_2$ system in the engine room?
- Does the vessel's SMS cover the necessary steps including; crew mustering and head count, shutting down the fire flaps, vents, fuel pumps and the main engine, prior to releasing $CO_2$ into the space?
- Are other crew members aware of the limitations of using $CO_2$ in an engine room fire? Would they be comfortable to challenge/question the chief engineer in a similar incident onboard the vessel?
- Are crew members aware of the procedures for entering the engine room after the use of $CO_2$?
- Do you have guidelines or procedures to check for hot spots during re-entry to the engine room after it has been flooded by $CO_2$?
- $CO_2$ and hazards to personnel – what are these hazards? How to detect gasses, prevent exposure and how to cure if exposed?

**1 What should the master have done as soon as the fire was discovered in the engine room?**

**2 Do your vessel's procedures cover the risk of "reignition" and/or "backdraft" when re-entering a space that has been flooded by $CO_2$?**

**3 What best practices would you suggest in order to safely and efficiently fight engine room fires using fixed $CO_2$ systems?**