

KISH P & I LOSS PREVENTION CIRCULAR KPI-LP-116-2013 **(Contamination of Marine Boilers by Oil)**

► Introduction:

The breakdown and malfunction of marine boilers are not new issues although it is well known that only a very thin layer of oil on the surface of the boiler tubes can cause local overheating and possible damage to the boiler. There has recently been a number of claims reported involving boiler damage caused by the presence of oil in the boiler feed-water system. In several cases, where a minor oil leakage has been discovered by the crew, the boiler has been blown down from the bottom instead of surface blowing resulting in a boiler totally covered with oil. During cleaning after repairs, the oil has not been properly removed from the boiler or from the feed-water piping system which again has led to cracks and an associated loss of integrity in high heat transfer areas.

Many of the reported incidents have led to expensive and time consuming repairs including cleaning of the feed water system and renewal of the boiler tubes. The purpose of this circular is therefore to remind ship-owners and operators of the importance of proper boiler operation and maintenance, and to highlight the relevant control measures for preventing, and where necessary handling, oil leakages into the feed-water system.

► Various reported cases:

The most common sources of oil contamination are leaking heating coils in fuel tanks and fuel heaters or lube oil heaters.

-In one recent case it was alleged that fuel oil had been detected in the hot-well which had come from a leak in the fuel oil purifier heater a few weeks earlier. The defective heater was replaced with a new spare and the hot-well was cleaned. The boilers were then put back in operation. A few weeks later the crew noticed a low-level-alarm in the hot-well tank and further investigation revealed water leaking inside the furnace. Opening of the boiler revealed several cracks in way of the fire tubes.

-In another case an excessive amount of HFO was discovered in the hot-well. No oil detection alarm sounded since the alarm had been disconnected due to problems with the detection system in the observation tank. During the inspection it was discovered that the feed-water system was completely polluted by oil, and as the common circulating pump was running, this also included the exhaust boiler. The investigations also revealed a

feed-water leak into the flame chamber, due to a crack in the wall panel in the auxiliary boiler, and some broken pin tubes due to local overheating. The cause of the feed-water contamination was found to be a broken heating coil in one of the HFO tanks. The heating coil had been renewed during the previous dry-docking, and further inspections revealed that the coil had been mounted with some pipe clamps missing and as a result, vibration had caused the breakdown of the heating coil. The ship-owner decided to take the vessel off-hire for a complete cleaning of the feed-water system and re-tubing of the defective pipes in the auxiliary boiler.

Consequent issues such as disconnection of the oil detection alarm for the hot-well may lead to major damage. The breakdown may have been avoided if the alarm had been working and the situation would no doubt have been discovered at an earlier stage.

The most dangerous type of water contamination is heavy fuel entering the steam or condensate from a leaking heating coil or heat exchanger. If the problem is not discovered in time, the boiler can be completely destroyed by overheating due to reduced water flow and minimized heat transfer/cooling of the boiler tubes. The immediate effects range from foaming and carry over in oil fired boilers to the malfunction of boiler water level controls and even protective shutdown devices. More severe oil contamination may lead to a collapse of the heat transfer rate through the boiler steel, which contributes to a higher metal temperature than the design value.

► Preventive Measures:

The following practices and preventive measures should be considered in order to avoid extensive damage due to oil contamination:

1. Alarms, monitoring systems and automatic safety shutdown functions should be tested regularly to ensure that they function properly. Safety alarms and automatic shutdown functions must never be bypassed.
2. If the boiler plant is, nevertheless, operated with bypassed faulty safety shutdown functions, a continuous visual watch should be kept on the water level and any potential oil contamination in the hot-well tanks.

3. Filters installed in the hot-well tank must be replaced regularly or as required. As small amounts of oil cling to the filter material, it is important that the filtering material is carefully monitored and replaced as necessary.
4. Ensure that the oil detecting device in the hot-well tank (if fitted) is working properly.

► Corrective actions:

If there is a suspected oil leakage into the feed-water system, carefully examine and hydro test all relevant heating coils, heat exchangers and other potential leak sources in the steam/condensate system in order to identify the origin of the leakage. Be aware that there could be more than one leakage. The following practices and corrective actions should be considered when oil is discovered:

1. If oil is observed in the hot-well it is recommended to check whether a dark oily film contaminates the boiler water level glasses inside. If so, do not blow down the boiler from the bottom; just surface blow several times. If the boiler is bottom blown, it will become totally covered in oil.
2. After repairs, the piping system, heating coils, pumps, hot-well and heaters have to be cleaned of all the remaining oil. Manufacturers' recommendations and procedures for cleaning should be followed.
3. The boiler must not be started up again until an oil-free feed-water supply is guaranteed.

► Recommendations:

To prevent boiler damage caused by the presence of oil in the boiler feed-water system, the ship's engineers should follow manufacturers' recommendations and highlight the above preventive and corrective actions in their procedures.



Furthermore, it is recommended to:

- Encourage the crew to report any accidental damage so that it can be inspected and/or repaired as necessary and as soon as possible.
- If repairs on the steam and heating system have been carried out during yard stay, proper inspections should be conducted to ensure that heating coils are properly mounted according to class requirements.