

**RISKS FOR TANKERS IN DER REPAIR AT SHIPYARD**

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Ship repairing is an inherently hazardous operation due to hot work in tanks with explosive or toxic fumes and other hazards. The most common and dangerous cause of accidents during dry dock, explosions / fire can lead to disastrous damage to both ships and seafarers.

Fires can spread quickly because of the flammable chemicals that are being used in the repair of the vessel, or because of the flammable materials contained at the dry dock (e.g., fuel, gas, paint, welding equipment, etc.). During dry docks, the engine room is filled with various electrical connections, and a short circuit can cause a fire. Over the years, hot work in docks, both on ships and onshore, has resulted in many serious fires and explosions that have caused death and serious injuries. On ships in docks, hot work may be carried out in connection with routine maintenance or voyage repairs. The situation is aggravated by the fact that during the repair period several ship's systems may be out of operation [1]. The ship and personnel aboard can thus be exposed to unexpected and unfamiliar risks and hazards. Masters of ships have the prime responsibility for the safety of their ship and everybody on board. No hot work should be carried out on board a ship in a dock without a written permission from the master or other officer in charge. If the master or other officer agrees to hot work being carried out by shore personnel, they should warn the personnel of any relevant hazard and take steps to ensure that all necessary precautions are taken. Care needs to be taken before any hot work is undertaken on board a tanker to ensure that all flammable materials and residues are removed from the area before the work begins and that the area remains gas free throughout the work. Guidance on such work can be found in the International Safety Guide for Oil Tankers and Terminals. In addition, OCIMF recommends that if a Company intends to assign a contract to carry out the work, whether construction or repair, it should be ensured that potential Shipyards have an HSE (Health, Safety and Environment) Policy and perform all work under a formal HSE Management System. This System should be adequately documented with an HSE Manual and be shown to be effective in implementing the aims and objectives of the Shipyard HSE Policy [1].

The standard of tank cleaning and gas freeing required when a vessel is proceeding to drydock, or a repair berth is dependent on the type of work to be carried out and the facilities available at the dockyard or berth. The Company will advise the vessel in good time of the standard required. The Company should arrange for the Ship to arrive with all cargo tanks, ballast tanks, void spaces, pipe tunnels, cofferdams, pump rooms and empty fuel tanks in a clean and gas free "safe for entry" condition and/or "safe for hot work" condition, if required, in accordance with local regulations. All cargo, vent, inert gas, and cow lines together with cargo heating coils and lines should have been flushed and/or ventilated. Fuel lines and associated equipment should be similarly cleaned so far this is practical "safe for entry" criteria are defined as: -Oxygen content of 21% by volume; -Hydrocarbon vapors not more than 1% of the Lower Flammable Limit (LFL) and Toxic gases below the relevant permissible exposure limit [2].

In tanks where significant work is to be carried out, the tank bottom and horizontal stringers and other major surfaces of tank structures should be cleaned of any significant oil residues. Further on, local cleaning may be required once access is obtained to the work site and cleaning can be further assessed. If there is work in an adjacent tank it may be necessary to remove residue from the other side of the bulkhead. In case removal of residues is allowed after the ship has entered the yard, hot work should be prohibited until the operation has been completed and all residues removed.

Prior to entry into the Yard an independent certified chemist should test all lines and tanks. On completion of the tests appropriate certificates should be issued to the Company representative and the Master. It is important that any tank which is not certified as being safe for entry or safe for hot work is clearly identified as such [2]. The continuing maintenance and verification of the status

of any tank or space throughout the repair period is the responsibility of the Yard. During this initial and any subsequent gas free examination a deck officer must witness the gas measuring result and ensure that same is carried out in accordance with standard gas measuring procedure requirements.

In addition to above, the following must be adhered to:

- The Master and Chief Engineer must ensure that gas free certificates are renewed whenever so required.

- No work must be commenced before the gas free certificate has been issued.

- On tankers hatches and tank domes are not to be closed on any account as gas may be present in the rust layer on bulkheads, superstructures and in pipes. It should be made the rule, however, to swing the hatch covers / tank domes over the openings to prevent rainwater from entering the tanks. On vessels where hatches are not suspended over the openings, they can be held open by means of double-angle cleats [3]:

- All tanks must be free of sediments or rust which may contain gas pockets. If sediment or rust is found, it must be removed in a safe manner.

- Once the ship is in the Yard, the main areas of concern with respect to safety are the following:

- Establishing and maintaining safe working conditions.

- Ensuring that all parties involved are aware of what work is being done, by whom, where and when.

- Securing the personal safety of the ship's personnel and others. Ship officers and Yard's Safety Staff should have the authority to stop any work, which is considered unsafe.

- Shipyards should ensure that the personnel and contractors comply with all relevant national statutory requirements and approved codes of practice.

- Protection of the environment.

The Master should be given copies of the Yard's safety and security arrangements and ensure compliance with these requirements:

- Fixed firefighting system, such as CO<sub>2</sub>, should have their normal operating means disabled so they cannot be inadvertently operated

- Charged fire hoses should be available at each location where hot work is being carried out.

- The Yard should have fire patrol organization on the ship.

- Fire watchers should be stationed in the vicinity of all hot work locations provided with appropriate extinguishing media.

- Combustible material should be removed from all work locations to eliminate the chance of fire.

Particular attention should be paid to ensure that environment pollution does not occur during shipyard repair period. Issues to be addressed should include [4]:

- All tank cleaning residues, including slops and tank sludge, must be disposed of properly in accordance with governmental regulations and MARPOL 73/78.

- Deck scuppers are plugged or led to facilities

- All transfers of liquids within the ship are planned so as to avoid accidental discharge of oil mixtures.

- Opening of any system should not release any fluids or ozone depleting substances, and ship's sewage should be disposed of in accordance with governmental regulations and MARPOL.

When the vessel is to stay in a shipyard or a dry-dock, the Master and his/her Officers should maintain the same safety and security standards as if in port. The Master and his/her Officers should request that the same level, if not increased, of safety precautions and safe working practices should be strictly applied by the dockyard workers to prevent not only personal injuries but also damage to the vessel itself, such as a fire or stability accidents. Close cooperation between the vessel's deck and engine officers and the shipyard engineers is required.

We are well aware of the accidents at sea, but dry dock accidents can be just as dangerous. There is always a potential risk of explosion in yards. Preventing dry dock accidents is a significant challenge, mainly because dry docks are especially dangerous workplaces. The most common and

dangerous cause of accidents during dry dock - fire - can lead to disastrous damage to both ships and seafarers (Fig. 1) [4].



Fig. 1. Fire on the m/t Jag Leela

The severe fire broke out on the Jag Leela, a 21-year-old Aframax tanker, which was under repair at Waruna Shipyard in Belawan, Medan (Fig. 1).

An explosion which wrecked the Norwegian Tanker “Man tilla”, from Tonsberg, Norway, resulted in at least nine fatalities and with many others badly injured. It occurred in the Bethlehem Shipbuilding Corporation, Sparrows Point, Md., The vessel was undergoing repairs in drydock.

An explosion and fire aboard an Aframax tanker at the Turkish Tuzla Shipyard took the lives of two workers, while 11 more were injured. The incident occurred aboard the Hong Kong-flagged crude oil tanker LR2 Poseidon during maintenance works at the repair yard.

Chemical type of explosion occurred inside the Residual Oil Tank onboard m/t “Sri Asih”, on November 3, 2020 at Sefine Shipyard, Turkey & consequent injuries of shipyard workers during hot work on main deck. In addition, the explosion heavily damaged the vessel’s steel structure and piping system (Fig. 2).



Fig. 2. Damage of bulkheads of residual tank m/t “Sri Asih”

Principal Causes of this accident:

- Lack of Supervision;
- Shipyard and Vessel Safety Standards Negligence;

- Work Permit Negligence;
- Error Chain due to improper compliance of Maintaining Ventilation of ROT tank, No Inspection of Tank, Buildup of Residues, Using Hot work without permission by Yard Workers, No Stop Work Carried out.

The accidents occurring during ship dry docking indicate both the failure of the technical solutions as well as the frequent occurrence of human error. The human factor is invariably a weak link in safety systems. It may be the first factor initiating undesirable events. In many cases, it is not a direct source of danger, but its incorrect actions intensify the dangerous development of events, which can have tragic and irreversible consequences [4].

## REFERENCES

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2. OCIMF Health, Safety and Environment at Newbuilding and Repair Shipyards, 2003
3. A.C. Antoniou, Safety of Ships in Yards: Ship and yard measure/responsibilities, 63 pgs
4. International Safety Guide for Oil Tankers and Terminals (ISGOTT 6), IAPH/ICS/OCIMF, 2020, 450 pgs