

# A Research on Safe Ship Recycling

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**Abstract:** India is a top leading country in ship recycling. Basal Convention, Hong Kong ship recycling convention has given some rules regulations for the ship recycling. Author has done study and research in safety issues related to ship recycling and how to mitigate the problems related to occupational hazards in ship recycling.

**Keywords:** Ship recycling methodology, safeties in ship-recycling, Poly-Chlorinated-Biphenyl, asbestos problems and solutions, automation in ship recycling.

## 1. Introduction

Ship recycling is an essential business as safe disposal of ship is an important task. My research and study finding shows that followings are the issues in ship recycling:

### A. Presence of hazardous Chemicals on the ship

After the last journey of the ship to scrap-yard, ship consists leftover metal, Chemicals, Polychlorinated Biphenyl, Perfluoro Sulphuric acid, machineries, asbestos, rock-wool, waste oils, rust, heavy metals, grey water, black water, paints, domestic-garbages, ropes, Plastics, Bio hazardous materials, Narcotics left in medical locker carried for treatment, Carbon, Salt particles, etc.

Ship recycling output gives productive ferrous metal which is sold to the metal buyers.

Chemicals kept on the ships for use in engine room or in tanks of chemical tankers causes lot of health hazards for example residue of Benzene liquid leftover in scraped-chemical vessel can pose Carcinogen threat on the workers therefore It is very important that any ship arriving in the scrap-yard must be tank cleaned to the extent of hundred percent efficiency. Further after reaching in the scrapyard ship should be assessed for the no presence of residual such chemicals, in case ship is still having residual chemicals then further safe cleaning with high quality personal protective suit will ensure the ships getting green signal in this regard. In second example if H<sub>2</sub>SO<sub>4</sub> is the leftover from the scrapyard arriving ship then it will create the health problems to workers due to corrosive fumes leftover in the tank, hence again it becomes mandatory for the ship to pre-clean all tanks and arrive in yard with green signal. There are many chemical presences in the ship can cause problems to yard-workers like Vinyl Chloride, Hydrochloric acid all can give Chlorine toxicity. Bottom-line is that no ship should arrive in the scrap-yard without cleanliness.

### B. Polychlorinated Biphenyl problem

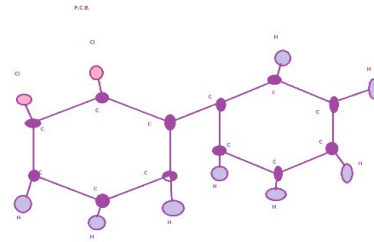


Fig. 1. Poly-Chlorinated-Biphenyl

PCB is a harmful residual substance on the ship, PCB is used in transformer liquid, In lubricants etc.

PCB is a Genotoxic, Neurotoxic, Carcinogen substance and also can cause health issues related to Thyroid alteration, Fatty lever problems etc.

Yard worker must be trained to handle such substance only with protective wearing no attempt should be made to touch, inhale or ingest such fumes or liquids.

### C. Per-Fluoro-Sulphuric Acid

Corrosive liquid very harmful to yard-workers therefore again protective wearing in handling plus training will be required for handling of such chemicals.

### D. Machineries removal

Ships main-engine, Auxiliaries and most of machineries falls under category of heavy lift therefore proper training is required to yard workers like how to use overhead gantry engine room crane and how to use heavy chain block etc.

### E. Asbestos

Asbestos are the naturally growing minerals which has fibers. Mainly following types of Asbestos are found and used in various places: Serpentine Asbestos-These are also known as Chrysotile or White Asbestos; second category is Amphiboles which is known as Crocidolite or Blue Asbestos. Due to environmentalist voices nowadays, Asbestos use is reduced in the ship. Asbestos is a silent killers of yard-workers as Asbestos fibers spits into Fibrils and further gets entry into the Lungs and Blood of Human being, Nico Van Zandwijk, Glen Reid & Arthur L, Frank (2020), *Asbestos-related cancers: The hidden killer remains a global threat in expert review of Anticancer therapy*,20: 4,271-278.

Yard worker must use protective wearing in handling of highly dangerous Asbestos. Breaking of Asbestos Causes

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Fibrils to fly in air and contaminate the Lungs.

In case Asbestos is present in the insulation material then use High quality masks Drager and many other brands makes masks for handling of chemicals and other substances. Never break Asbestos into pieces try to keep them intact and dispose them safety to ashore.

Asbestos is a Carcinogen substance hence very high-level awareness should be present in the workers. Give them training of handling and also require proper supervision.

#### F. Rock-wool

Rock wool is obtained by the fibers of Basalt rocks. Basalt pieces have to be melted to  $\Rightarrow$ 1700 degree Celsius and then spinning of material gives Rockwool. Rockwool is used as insulation material in the ship along with Asbestos. Rockwool fibers inhaled in the lungs can create health issues hence Yard-workers should take safeties while handling the Rockwool's.

#### G. Waste OILs

Waste oils like HFO, DO, Tank leftover oil, crude oil, Sludge oil all are harmful substances, these oils also have small degree of toxicity. Yard workers should be trained for safe disposal of these waste oils to shore. Never dispose waste oil in the sea below scrapyard. Yard workers must use best quality protective wearing like Drager3300 & A2P3 or Moldex A1P2 Organic gas masks etc., for better protection.

#### H. Rust

Beyond doubt a ship arrived in scrapyard will be having substantial rust. No Yard worker should ever inhale flying rust ashes as it will harm to Lungs.

#### I. Grey Water, Black Water and Paints

Collection, transfer of fluid using pumps should be carried out in safe manner. Paints should be treated as residual chemicals. Training and protective wearing will help to yard workers in safe handling.

#### J. Domestic Garbage, Ropes and Plastics

Ships arriving in scrapyard will be having domestic garbages, ropes in stores and also plastics. Yard workers must not throw these materials in the Yard-bottom. Always dispose them ashore.

#### K. Narcotics drugs and Leftover medicines

These should be treated as medical biological hazardous material and should be disposed ashore.

#### L. Carbon Leftover and Salt Particles leftover

IT is important to safely remove the Carbon and Salt particles from the ship. Any Carbon dust inhalation could be surely harmful to Yard workers.

#### M. Use of Automation, Robotics in the ship recycling

COBOT operated plasma cutting tool can help yard workers to overcome the injury and burn problems. Above is plasma cutting tool.

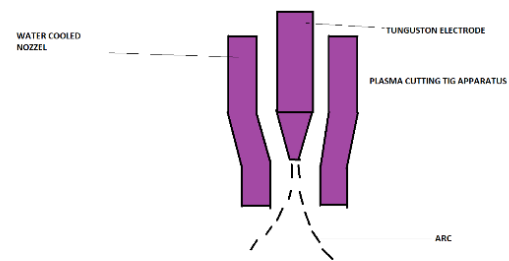


Fig. 2.

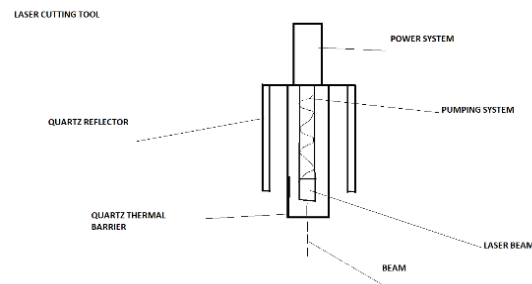


Fig. 3.

Above is a Laser cutting tool, COBOT using laser cutting tool can cut the ships part with reduced human interface and with less injuries in ship cutting.

Cobot can cut the plate by shearing, Laser cutting or by plasma cutting, O<sub>2</sub>-C<sub>2</sub>H<sub>2</sub> cutting etc.

#### N. Ship recycling management flow chart

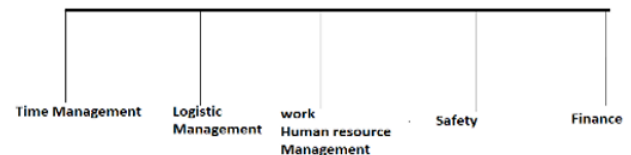


Fig. 4. Ship recycling yard work flowchart

Safety Department must give proper training to all yard workers. It will improve the safety. Once ship arrive in the port then inventory of all hazardous material should be taken and reported to administration should be done. Yard must keep medical center and medical facilities at close by location.

## 2. Conclusion

By use of semi automation, automation in work, wearing of protective equipments, training and supervision in work, we can improve the safeties in all recycling yards. It will be of great benefits to ship recycling business.

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