Ship recycling and India

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***Abstract*: Retirement of ships usually happens after 25-30 years. According to IMO RULES, ships can be recycled, placed underwater as reefs, or used for educational purposes as museums and training young (trainees at military and marine academies). The majority of ships are recycled, if it is done properly then it is a good venture but if it isn't then major health and environmental problems can arise. The abundance of labor and low government intervention in this sector worsens the situation. This paper throws light and concentrates on the challenges faced by the ship-breaking industry. Also, we study the world's largest ship recycling yard Alang-Sosiya and how proper management can be implied to regulate safety and wipe out hazardous activities from it.**

***Keywords*: Hong Kong Convention, Inventory of hazardous materials (IHM), Cradle to cradle passport, Pin and cap stiffeners, Ship Recycling Act 2019, Alang-Sosiya**

I. INTRODUCTION

The global economy relies on the shipping industry as ninety percent of international trade is done by massive cargo ships. A ship usually operates not more than thirty years and then they become obsolete. It is operated all through its lifetime until the cost of maintaining it exceeds the money to scrap it. So, in general, the marine liners sold these ships to recyclers. Once the vessel is brought ashore and it is beached at various shipping yards, all the usable and recyclable parts are first dismantled and segregated.

Shipbreaking is defined as taking apart of the ship in order to get metal from its parts and to sell its parts in scrap. Ships are made up of huge amounts of steel and its scraped metal is sold in LWT to different steel mills. The metal is cut into smaller pieces and sold to the companies/brokers. Who usually melt and process it as per needed things.

Most of these ships were built before there was any ban on treacherous material. This puts thousands of recycling worker's life in peril. In the last decade, only nearly 400 workers lost their life. Ships are not designed or constructed keeping in mind the needs and demands of recyclers, they are built according to their buyers which want it to be prudent and cost-efficient.

During the 2016 recession, the freight dropped significantly. That was the year when most ships were broken down. UAE and Greece were the biggest dumpers and about 90 % of these ships were broken in the Indian subcontinent.

Figure: Ships dismantled in last few years

II. SHIP RECYCLING INDUSTRY

Due to strict environmental laws and labor regulations, the ship-breaking industry has vanished from the developed world. Leaving developing nations to corner the market. Major countries which are in this sector are India, Bangladesh, China, Pakistan, and Turkey.

Recycling of ships provides stimulus to the economic growth of these countries as 10-20 percent of the steel consumed is obtained from ships.

It is one of the most dangerous jobs in the world. When ships are sent to these yards not only ships die, workers too lose their life. The nearby water bodies are polluted to an unprecedented level. The labor is cheap and plentiful in the subcontinent with the minimum wage as low as three dollars a day. Plenty of ships to break and cheap labor makes it a very profitable business for yard owners.

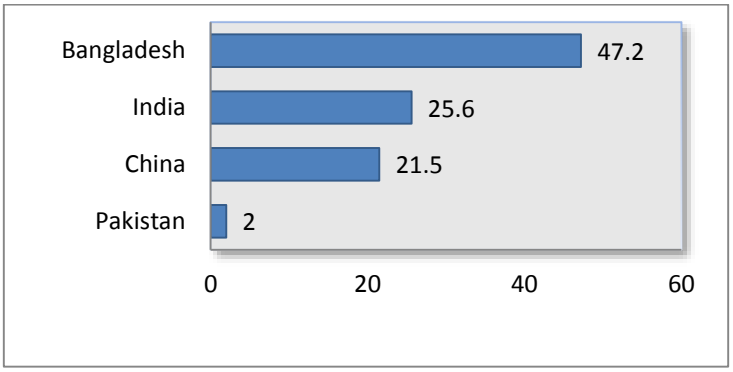

Figure: Ship breaking by countries in percentage.

Most of these dumped ships contain many hazardous materials like asbestos, PCBs, and heavy metals. But most ship recycling yards located in the subcontinent don't have the proper infrastructure to deal with. The shipbreaking industry administers a sustainable environment since it recycles huge amounts of ferrous and non-ferrous metals. Unfortunately, this unhealthy practice overshades its positive effect.

IMO adopted the Hong Kong convention in 2009, to tackle this situation. The ship recycling process can be improved by firstly improving the design of ships and secondly providing a green recycling environment.

Green Ship recycling was a term coined in Hong Kong convention means safe and sound working conditions for the workers. But implementing these reforms increases the cost of recycling. So, the main motive is to decrease the cost of green ship recycling and improving ship designs keeping in mind the requirement of recyclers.

Figure: IMO I683E Hong Kong Convention

III. IMPROVING RECYCLING

The main aim of designing ships for recycling is to make most of it and to reduce the hazards caused by it. Documentation of hazardous material present on board makes it easy for recyclers and also mariners to make them aware of what they are dealing with. This is also stated in Hong Kong Convention 2009 according to (Lloyd's Register, 2011)

Design for recycling has three key objectives:

1. To reduce or replace hazardous materials.

2. To accurately provide an Inventory of Hazardous Materials.

3. To make the ship easy to dismantle

IV. I Reduce or replace hazardous materials

Is there a replacement available for existing harmful substances is the major concern regarding this problem. Finding a greener alternative with desired properties needs a lot of research and funding. Sailing ships are a city in itself producing all sorts of waste and harmful material one can think of. As a result, ship recycling becomes a risky business not only to the environment but also to human life indulged in this sector.

Generally, these harmful substances were in use because of their superior properties, and finding an alternative is really hard. Since these substances have been used frequently in the past of shipbuilding, it has now become a big hurdle for the change. But still many of these substances are getting replaced. As in place of Asbestos, cellulose fibers have been introduced as an alternative with a significantly higher recyclable percentage of about 85%. CFC can be replaced by HCFC but still it causes harm to the stratosphere but to a lesser extent as compared to its counterpart and now companies have come up with the alternative to Polychlorinated Biphenyls, some of the replacement substances are mentioned in the figure. Organotin compounds are now getting replaced by biocides such as Cu(I) salts and Triazine Irmgard 1051 chemicals which are less hazardous than the Organotin compounds.

Product containing PCBs	**Use of PCBs in product**	**Replacement chemicals**
Transformers (electrical machinery)	isolation fluid	silicone and mineral oils
Capacity's (electrical machinery)	Isolation fluid	ester-based materials
Sealants (construction)	• plasticizer	chlorinated alkanes
Paints and floor finishing (construction, interior design)	plasticizer	chlorinated alkanes
Carbonless copy paper (offices)	solvent for dyes	isopropyl-substituted biphenyls
Electric cables	plasticizer	halogenated organic compounds and chlorinated alkanes
PVC	flame retardant	antimony trioxide and aluminium trihydrate

Figure: PCB sources and possible replacements

IV. II Inventory of hazardous material

IMO adopted Hong Kong Convention in 2009 which emphasize on maintain an Inventory of hazardous materials (IHM) and also EU Ship Recycling Regulation (EU SRR) in 2013. The deadline for adopting the EU SRR was 31st December 2020 which made it mandatory for ships over 500 GT regardless of the flag to carry a valid and certified IHM. Maintaining IHM of new ships is easier than existing ships. Shipbuilders are required to notify the threshold value of harmful substances present on board.

Substance	**Origin**	**Harm**
Asbestos	Engine room	Lung cancer and asbestosis
Polychlorinated biphenyls	Cable insulation, capacitors, etc.	Carcinogenic, bio accumulative diseases
Ozone-depleting substances	Blowing agent for insulation of LNG carriers, extinguishing agent	Environmental harm
Organotin compounds	Anti-fouling paint	Neurotoxin effects
Heavy metals	In paint and lamps	affect nervous system
Oil and fuel	Engine room	May result in fire and explosion

Figure: Various hazardous material present on board

Maersk Line is introducing Cradle to cradle passports which will allow their new triple E ships to be divided into three sections while recycling. Namely High (will contain high-grade steel), Low (will contain low-grade steel) and miscellaneous (others like harmful substances). By this reuse and recycling of ships becomes easier and pollution will become a thing of the past.

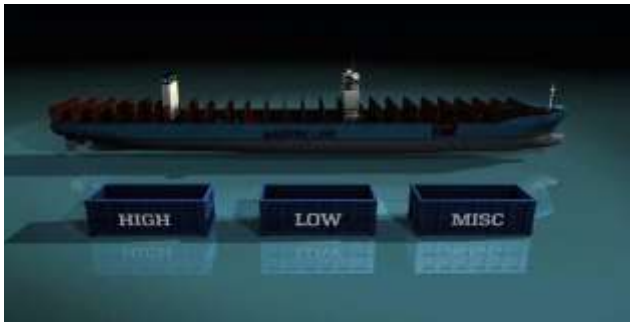

Figure: Cradle to Cradle Passport of Maersk Line

IV. III Changing the design

Redesigning ships requires a lot of time and labor but some small changes in the hull or even engine rooms can have a big impact. Standardization of various parts can ease the process of recycling. Modifying engine room so that pre-vacuum cleaning can be done which will prevent an accident. Using Pin and cap stiffeners in place of glue for insulation. Proper lifting handles should be provided for the quick and harmless dismantling of bridges.

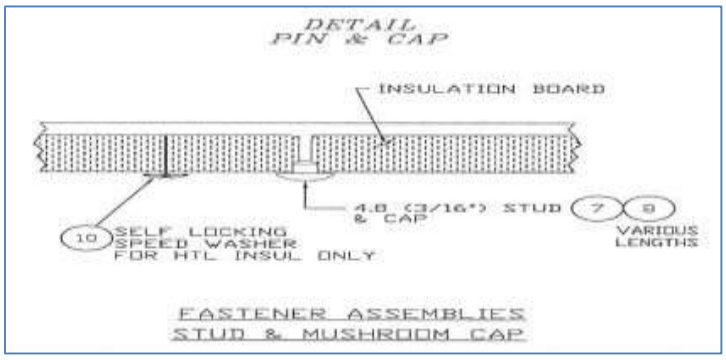

Figure: *Weld pin and cap*

V. SHIP BREAKING AND INDIA'S ALANG-SOSIYA SCRAPYARD

The shipbreaking industry was observed by the government of India in 1979 when it was under the steel ministry (manufacturing sector). In 2014 it was handed over to the shipping ministry. This industry employs more than 30000 workers directly and 5 lakhs indirectly and generates revenue of 6000 crores annually.

World largest ship recycling yard Alang-Sosiya was founded in 1983 with just 5 ships coming for dismantling which was around 400 in 2011. Every year 3 million tonnes of steel is scrapped in Alang and is rerolled in mills near Bhavnagar. Also, nearly thousands of shops resell parts near the yard such as furniture carpets and refrigerators.

Figure: Location of *Alang*-Sosiya in Gujarat

The Indian government is continuously improving this yard as it has great potential and is leading the world in ship recycling since the 1990s. The Indian government also signed a deal with JICA (Japan International Cooperation Agency) worth $76 million to

modernize environmental protection of ship recycling yards. Also, under project Sagarmala a budget of 10 crores has been allotted for the training and skill development of workers.

Still South Asian Recycling yards have a bad reputation that no health and safety measures are followed here. Data supports their concern very much.

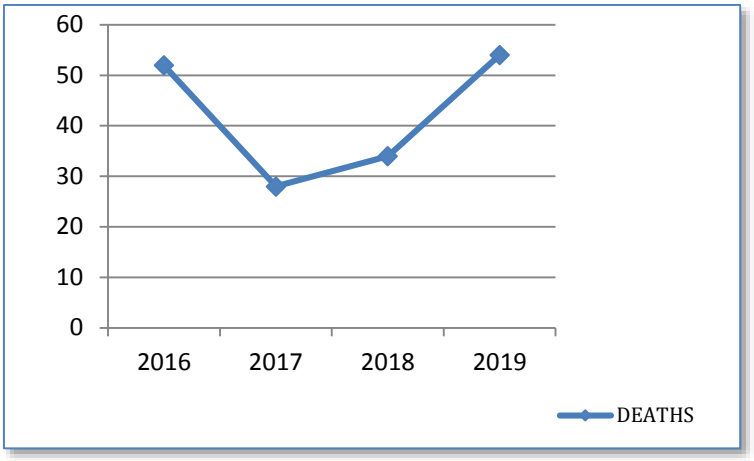

Figure: Death of workers at ship recycling yards in South Asia

The earliest clusters of coronavirus were traced in Ocean liners as a result cruise tourism is at its rock bottom. U.S. and European health authorities have issued no sail order which made almost all cruise ships stranded. One's loss is others' gain. Cruise liners are now coming at Alang for their last voyage. Alang Shipbreaking yards act as a mirror of the economy when the economy is good lesser ships come for recycling as export imports are on the rise. But when the economy is down like in most of 2020 large numbers of cruise liners were beached at Alang.

VI. CHALLENGES AT *ALANG*

The two main challenges faced by the shipbreaking industry in India are pollution and the safety of workers working in these yards. Also, Alang faces stiff competition from its counterparts in Bangladesh and Pakistan. A large amount of waste is also generated on the site which can be categorized into three main parts namely solid, liquid and gaseous waste. Workers inhale harmful fumes while welding as there is no proper ventilation present causing all sorts of respiratory diseases.

A study published by the European commission in 2016 revealed quite horrific results; they used Piram Island which is home of endangered species of the turtle as a control site and compare it with Alang.

Pollutant	Percentage of pollutant	Heath Problem
Mercury	500%	Neurological disorder
Cupper	25%	Liver and kidney failure
Petroleum Hydrocarbons	973%	Cancer
Zooplankton	66%	Harms marine life
Bacteria	605%	Bacterial diseases
E. Coli	349%	Diarrhoea
E. Faecalis	394%	Urinary tract infections

Table shows the percentage of various pollutants

VII. *THE RECYCLING OF SHIPS ACT, 2019*

This act was long-awaited as India was a signatory of the Hong Kong Convention as it was introduced in parliament and was put into immediate effect. This bill is applicable to all ships listed in India or entered its port except for any warship operated by the government. It defines what recycling means and prohibits the use of hazardous material in the manufacturing of ships.

Shipowners now have to maintain *IHM* and have to obtain a certificate from the government which will be valid for only a five-year period after that they have to renew it. Recycling facilities should have adequate safety and fire extinguishing facilities. Recyclers should have adequate certificates to operate a recycling yard. A certain ship recycling plan will be implemented for the process. They can be fined if any oil spill happens or even imprisoned for the same. This *Ship Recycling Act 2019* will enhance the ship breaking industry in India and with proper safety measures India will surely become an epitome in this industry.

Finance Minister Nirmala Sitharaman while presenting the 2021-22 budget announced that "ship recycling capacity will be doubled by 2024 and efforts are being made to bring more ships from Europe and Japan." Also 1.5 lakhs new jobs are supposed to be generated in the near future.

VIII. CONCLUSION

Environmental hazards and conditions of workers undermine the noble cause of recycling. There is a critical need for the plan which will make it cost-proficient and furthermore environment friendly. Naval architectures now have to redesign the ships accordingly Implementation of measures like mentioned in the Recycling of ship act 2019 should be applied on the field, not in papers alone. Severe assessment at yards by the concerned officers can save numerous lives.

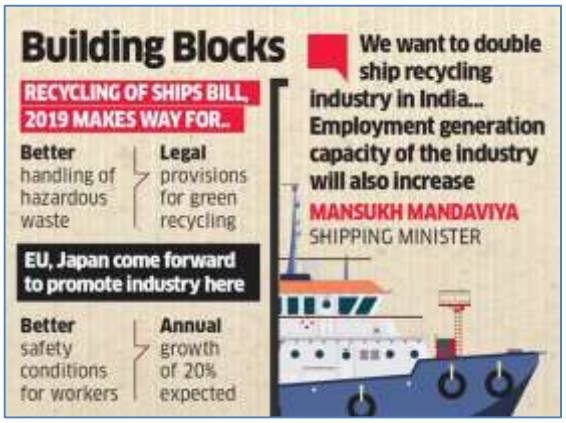

Figure*: Recycling of Ship Bill 2019*.

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