

UNDERLYING PROBLEMS OF SHIP RECYCLING INDUSTRIES IN BANGLADESH AND WAY FORWARD

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Abstract: *Ship recycling has been playing as a catalyst role for the economy of Bangladesh by supporting steel industry, shipbuilding industry and other industries and it has also been generating huge employments for the country. But, existing problems of this industry in terms of safety, health and environmental issues bring negative image for the country sometimes. This paper is aimed to identify the underlying problems of ship recycling industry at first and then analyze the nature of the problems to make it helpful overcoming the obstacles. A brief overview has been given focusing recent development of this sector. A guideline has been put forward to overcome all these problems in order to hold a strong position in the world ship recycling.*

Key Words: *Ship recycling, ship dismantling, safety, safety hazards, environmental hazards.*

INTRODUCTION

Shiprecycling is defined as the activity of complete or partially dismantling of a ship at ship breaking yard in order to recover components and materials for reprocessing and reusing. Usually, the decision to end the ship's life is taken when the maintenance costs start to exceed the forecasted income or when new international legislation enforces or when the ship stops to be of interest for the second-hand market. Re-use of scrap iron and steel, which is the main output of the shipbreaking industry, is an environment-friendly activity since it reduces the need for mining for production of raw metal of steel industry from pig iron. From energy saving and emission point of view, the production per ton of steel from scrap requires more than 5 times less energy and 7 times less CO₂ emission compared to steel production from iron ore [1]. Thus the ship recycling meets a key sustainability requirement in recycling of resources, if carried out properly.

Shiprecycling is mainly labour intensive industry and therefore, major shiprecycling countries are mainly developing countries. Until 1970s, shiprecycling was a common industrial activity both in the United States of America and in Europe. Specialized salvage docks, equipped with cranes and other heavy equipment, were used to scrap the ships, providing material for the steel industry. But increase labour costs and stringent environmental regulations caused the scrapping industry to be concentrated at the docksides in Taiwan and South Korea in the 1970s. But those countries lost interest in ship breaking as it was no more cost-effective and they rather focused on using their shipyards for building ships in the 1980s. After that, owners found alternative destinations in India, China, Pakistan, Bangladesh, Philippines and Vietnam for scrapping their vessels where health and safety standards were minimal and workers were cheap and desperate for work. Bangladeshi industrialists also took the opportunities

of this lucrative business which resulted importing more and more ship to Bangladesh. Thus, within a short period, Bangladesh established herself as a leading ship recycling nation in the international market.

Although the age of ship breaking in Bangladesh is more than 3 decades, but primitive working conditions and the lack of necessary control mechanism generally cause the scrapping yards as a source of environmental and occupational health problems. Again adopted preventative measures against the unsafe, primitive conditions of scrapping yards is still below standard.

This paper has highlighted the general practice of shipbreaking industry in Bangladesh. Based on the field survey and through study of working condition, infrastructure facilities and current practice, an effort has been made to identify the problems related to safety, health and environmental issues. Present status of the industry has been updated relevant to newly formulated rules and regulations. After analysis the nature of the problems, a brief guide lines have been given to overcome the obstacles.

SHIP RECYCLING INDUSTRY IN BANGLADESH: BRIEF DESCRIPTION, METHODOLOGY & PERFORMANCE STUDY

Ship-recycling industries have been located along the coastal belt of Bangladesh, from Bahatiary to Barwalia at Sitakund, some 20km southwest of Chittagong divisional city. The geographical location of the ship recycling zone is between latitude 22°25' and 22°28'N and longitude 91°42' and 91°45'. There are more than 100 registered ship-recycling yards located in this area. This is one of the major ship-breaking sites in the world where world largest LDT vessels usually scrap every year.

The process of shiprecycling starts in Bangladesh with the acquisition of the ship by a purchaser

(specialized broker or the operator of the ship breaking yard) when the ship owner decides to end the economic life of the ship. Typically, after necessary inspection and certification, the ship sails towards the breaking yard for dismantling. The beaching method is widely used by the local ship breaking yard in Bangladesh. The ship is generally sailed with its maximum speed using its own power during the high tide and forced to be beached over the flat muddy land. This method is a natural process where instead of installing expensive and heavy infrastructure for pulling and docking the ship, huge labour force is used. After recovering unused or partially spent materials, ship is cutting into small pieces. Gas cutting is widely used to make relatively small pieces from the steel structure. Minimum knowledge of safety and technological know-how are used in this process. So, sometimes this method leads to frequent accidents like explosion, death, fatal injuries and permanent disabilities. That is why, apart from economic benefit from this industry, the social and environmental costs demand huge attention for further development of this industry.

The past data of ship recycling showed that Bangladesh played a significant role in terms of LDT [2] in the ship recycling world, particularly during 2004 to 2009. In Fig 1, the share of Bangladeshi performance to the total world ship recycling in LDT is shown. It is clearly seen from this Figure that Bangladesh led the world ship recycling during 2004 to 2008 and India was just behind it. Before 2004, India was the number one in ship recycling for long period. However, currently (2009-2011) India has again retained their leading position in the ship recycling world leaving China/Bangladesh as their follower. The trend of Bangladesh showed ups and downs in early of this decade, but sharply increased in the last few years. In Fig 2, ship recycling contribution in year 2011 is shown in pie chart. From these Figures it is clear that Bangladesh has been maintaining very strong position among the world shipbreaking nations since year 2002.

ECONOMIC CONTRIBUTIONS

Various industries in Bangladesh such as re-rolling industry for steel making, ship building industry, heavy and light engineering industries etc are directly benefited from shiprecycling industry. Use of scrap which is the main components from ship recycling industries is shown in Fig 3. Of them, the recycled steel from the shipbreaking yards is an important component of the steel production in Bangladesh. Bangladesh has got more than 350 re-rolling mills and for the raw materials they are highly depend on scrap steel from ship recycling industry. Yearly statistics of steel market shows that shipbreaking is supporting up to 60% of total steel produced in Bangladesh [3]. More than 1,50,000 people are directly and indirectly involved in these industries.

Ship-breaking is supporting our indigenous ship building industry enormously. There are more than hundreds shipyards located in and around Dhaka Division. Few more shipyards also located in Chittagong, Khulna and Barisal division. Except export quality shipyard, most of the shipyards are making local quality ships for the inland waterways which is considered as the cheapest mode of transport for carrying passenger and commodities in Bangladesh. Every year more than 200 ships are added to the local fleet and main raw materials come from this scrap yard [4]. Considering the existing fleets and growth pattern of inland ships, approximately 35,000-45,000 tons of steels are needed in the local shipyards and workshops and these portion of raw materials (for building new ship and maintenance of existence fleet) are supplied by the Shipbreaking yard in Bangladesh. It is observed that due to the support from this scrapping yard, Bangladeshi shipyards are producing the ships at least 30-40% cheaper rate and this is only possible because scrap yard in supporting main raw materials of steel plate and structural members. Even doors, pump, generators, switch board, cable, valves, elbow, pipe, deck equipment, panel board, navigational equipment, fire fighting equipment, safety equipments etc are used in local ship from ship scrapping yards and thus contributing to build ship at a cheaper rate. Typical cost breakdown of cargo ship of inland standard using scrap material is shown in Fig 4.

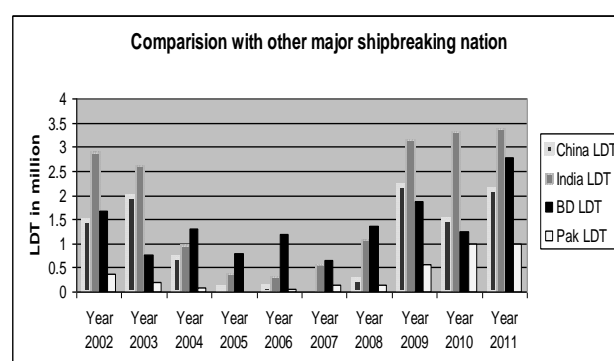


Figure 1. Comparison of Bangladeshi ship recycling capacity with other countries (2002-2011).

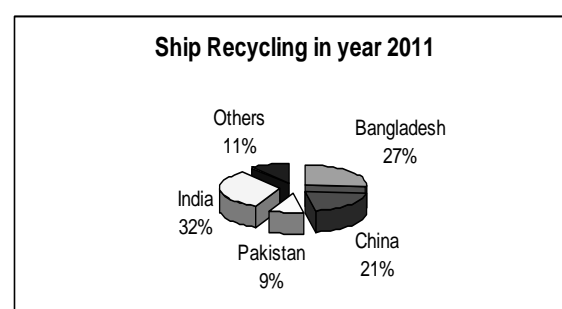


Figure 2. Contribution of Bangladeshi share of shiprecycling in 2011.

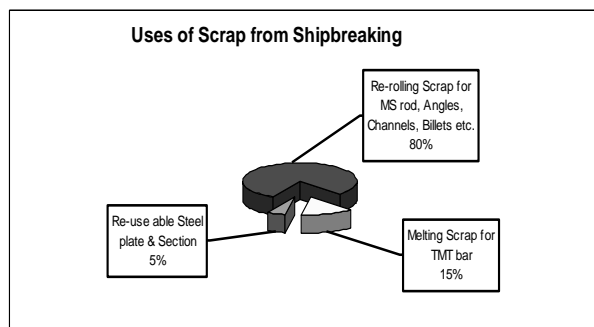


Figure 3. Uses of scrap from shipbreaking yards in Bangladesh.

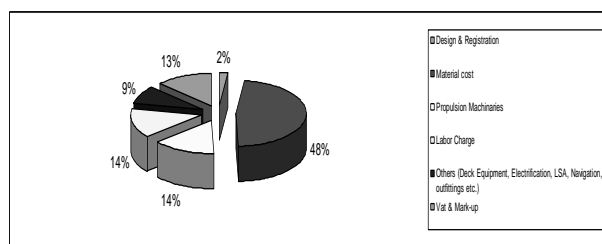


Figure 4. Typical cost breakdown of cargo ship of inland standard.

IDENTIFICATION OF GENERAL PROBLEMS OF SHIPRECYCLING INDUSTRIES IN BANGLADESH

Although, the basic construction material of ocean going ships is harmless structural and non-structural steel, but ship dismantling activities may generate lots of other materials like non-ferrous metallic materials, glass and wood, polymeric and composite materials, sludge water, oil, undifferentiated materials as well as dangerous solid substances such as asbestos. So, for a risk free, environmental friendly, energy conserving and economical ship recycling process comprehensive knowledge of the materials, regarding quality, quantity and location onboard is very important. Determination of work plan, allocation of human resources and position of tools & equipment used must be designed not only in the context of productivity but also in the context of maintaining safety and health provisions. Also strict adherence to well designed cutting plan for dismantling operations reduces safety issues and ensures quick and trouble free ship dismantling. Downstream management concerning removal/storage and handling on and from the ship must be planned in advance so that reception areas is able to accommodate hazardous materials safely. Cutting operations must be carried out in conjugation with well designed lifting and handling operation as well.

Shiprecycling industry of Bangladesh has been in the dominating position since last decades. But, the general practice based on the collected information identified the absence of safe working practice and sufficient control mechanism which is the main sources of environmental and occupational health threats. Existing problems may be categorized in the following broad headings:

Safety Problems

Lack of labour safety is one of the major concerns of present ship recycling industry in Bangladesh. Labours are generally unskilled and sometimes, they do not have even any basic training for the risky job like shiprecycling. Non compliance of the safety issues during cutting operation causes various kinds of accident. There is no standard sequence of cutting operation. Sometime the sequence is defined by labour themselves and it is varied with ship types, size etc. It has been observed that while starting cutting processes, labours usually cut all the side shells at first. During such practice, accident due to fall of plate is very common. Plates are carried away by group of labours without knowing the weight of the plate. Some time heavy plate weight as well as very sloppy and muddy ground make the plate carrying job very risky. While cutting at height in the main deck or upper deck, no special safety measure like erection of scaffolding, wearing safety belts etc. has been taken. As a result, falling from the height is a very common accident in Bangladesh. It is also observed that worker is assigned to work below others particularly where there is a danger of tools, equipment and cut sections or any other loose work item falling from the upper work location. As a result, accident due to falling of heavy object is also very common.

While cutting plate, no care is taken about removing coating and usually plates are cut with coating. While working in confined space, due to lack of enough safety measure like measurement device, safety suite, ventilations etc. serious accident occurs. Cutting operation in the cargo tank without following proper gas freeing and gas monitoring procedures cause serious fire hazard risk to the workers. Many minor accidents like cutting due to sharp edge, bruising etc. have not been reported. Lack of appropriate emergency response, rescue and first aid is also common in ship breaking industry in Bangladesh. Winch/ pully / crane etc are not tested periodically and so there is no way of ascertaining their capacity. This is risking occupational safety of the involved workers.

Fig 5 shows the percentile distribution of accident caused over last 4 years in shiprecycling yard in Bangladesh. Fire explosion especially for oil tanker is one of the major reasons for frequent fatal accident in Bangladesh. Inadequate safety measure also result in high fatality rate related to falling at height. Fall of

plate and parts causes 25% accident & toxic gas inhalation causes 16% accident.

Health Problems

Although shipbreaking is one of the most hazardous activities of any maritime industry, but most of the workers in ship breaking yards in Bangladesh have no basic knowledge about the impact of ship scrapping on health. As a result, particular hazard exposure especially generated by asbestos, PCBs, heavy metals and chemicals causes serious health problems of the worker dealing with shipbreaking industry. Asbestos is very risky substance. The workers dismantle asbestos materials without knowing the consequences of inhaling such materials. They went to their living space without taking shower, thus risking others persons who live with him. Exposure of poisonous paints like Tribtylin (TBT) causes serious health problem in shipbreaking worker's in Bangladesh. Most of the cutter has to work in very intense light of cutting torches. Though, they occasionally use goggles, but these PPEs are sometimes not up to mark for heavy duty works like ship breaking activities. Thus workers complain of facing problems like eye redness, tearing, burring sensation, blurring of vision and conjunctivitis etc after long working hour. Some workers complain of impairment of hearing after working in the harsh environment of shipbreaking industry where excessive noise is present.

A study [5] on occupational health of workers working in Bangladeshi shipbreaking industry confirmed that most of the workers were found to suffer from multiple disease and health hazard. Abdominal, urinary, muscle and skin problems as well as nutritional deficiency were also identified among the workers which were mainly caused due to toxic metal, oil and chemical contamination as well as excessive workload, long working hour, monotonous works, irregular eating, insufficient diet, unsafe drinking water.

Environmental Problems

Poor practice of present shipbreaking industry generates huge environmental pollution in the coastal area of Bangladesh. For example, cutting operation is generally advanced from forward to aft end slice by slice. While slicing the ship, little care is taken about the contained inside the double bottom or pipe. This action paves the way to release bilge, ballast water into the sea. Some times, the slice is pulled near to the yard for further cutting. During pulling/dragging, poisonous paint such as Tribtylin (TBT) causes heavy pollution of sea water and beach sand.

Limited environment protection is a major concern of shiprecycling industry in Bangladesh. Sound management of asbestos, PCBs, ODS, heavy metals etc. is virtually nonexistent. Due to lack of appropriate procedure and trained worker, asbestos containing material causes atmospheric pollution by

forming carcinogenic powder. Practice of stripping the electrical cables off their insulation by burning is another source of environmental pollution as it produces highly toxic gases such as dioxins, polychromatic hydrocarbons, etc. Disassembling of air conditioning and refrigeration systems can also result in the release of chloro-floro carbon series chemicals that are hazardous to the ozone layer. Some shipboard fire extinguishing systems is also the source of such gases.

Engine, pumps, compressors, motors etc which contain oils, oily substance should be stored on impermeable surface with shaded storage area. But in case of shiprecycling industry in Bangladesh, these equipment are stored in open space and thus soil is contaminated due to mixing of oil with soil.

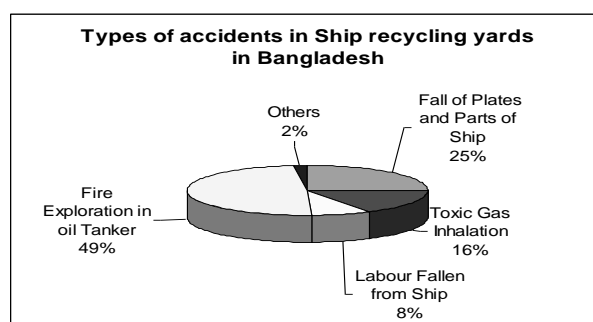


Figure 5. Accident statistics of shiprecycling yard in Bangladesh.

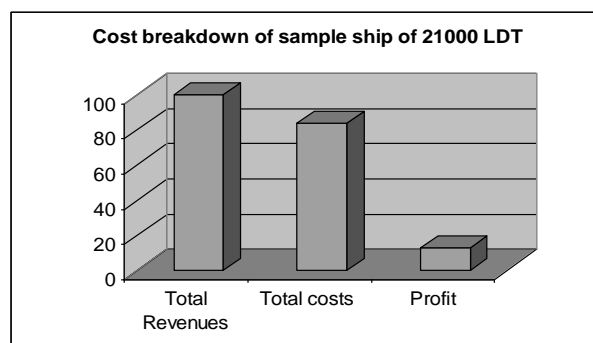


Figure 6. Cost breakdown of sample ship of 21000 LDT.

The World Bank study [6] already identified the accumulation of considerable amount of hazardous materials over last few decades in ship breaking area in Bangladesh due to poor practices and improper management of hazardous materials. It is also apprehended huge amount of hazardous materials entering in the society with equipment off the yards and emphasized the need for improving overall environmental management in shiprecycling yard in Bangladesh.

RECENT DEVELOPMENT OF SHIPRECYCLING INDUSTRY IN BANGLADESH

Although Bangladeshi ship recycling industry has been playing dominant role in world shipbreaking market since year 2002, but only recently have yards begun to care for safety, occupational health & environmental issues. Legal battle between environmentalist group and ship breaking association even brought temporary shutdown of all ship breaking activities in year 2010 for some time. This legal battle also brings some qualitative improvement of ship recycling industry as per instruction given by the Apex court of Bangladesh. Govt. declared the ship-breaking as an industry and placed under the Ministry of Industries by Gazette notification on 21 April 2011 by acknowledging the contribution of shiprecycling to national economy of Bangladesh. In the mean time, Ministry of industry has framed 'The ship breaking and ship recycling rules 2011' and Gazetted on January 11, 2012 [7]. Govt. has declared this industry as a thrust sector and looked to focus on upgrading the standard in respect of safety, health and environmental issues. Govt. also sought help from Norwegian Govt. in order to foster its efforts towards green shiprecycling in Bangladesh.

A pleasing development in shipbreaking industry is the establishment of mandatory asbestos removal center in every yard. In order to prevent the emission of asbestos-containing dust and handling of hazardous materials etc., the ship breakers must employ trained personnel in their yards. To improve working conditions and safety, the use of personal protective equipment is mandatory. Some mandatory requirements like ensuring training facility of all workers have to be implemented. In order to reduce manual workload of the workers, infrastructure development and mechanization of facility etc. are being implemented by the recycling yards now. Rest room, drinking water facilities are implementing now by each of the shipbreaking yards. Well-equipped fire fighting facility with necessary reservoir tank, foam tank are being installed in every shipbreaking yard. A 150 bed hospital for shipbreaking yard is setting up now for the treatment of workers. A limited training facility for the workers has been introduced for this industry from year 2011. Practice of stripping of cables and wires by burning has been discontinued in the recent time.

To improve environmental quality related to ship recycling yards, some mandatory infrastructures are being implemented as per instruction given by Department of Environment (DOE). Table 1 shows the usual practice in case of dealing hazardous materials from ship breaking industry in Bangladesh. A brief description regarding infrastructure that is implementing now or needs to be implemented [8] has also been given in the same Table 1.

WAYS FORWARD

Ship breaking is a labour intensive industry and labour related accidents/fatalities related to ship breaking is very frequent in Bangladesh. To improve these types of occupational healthy and safety related problems particularly for ship recycling industry, comprehensive labour training for all workers must be ensured. Basic mandatory trainings on first aid, health and safety, fire safety, use of equipment & PPE etc. are to be implemented for all workers. At the same time specialized training for identifying and dealing hazardous materials like asbestos, PCB's, ODS and heavy metal etc. is also mandatory. Currently Bangladesh is lacking these types of extensive training facilities and so for improving all the problems related to health and safety of workers, it must be implemented on priority basis.

All the available ship recycling methodologies are based on very simple principle and i.e. ship recycling is reverse engineering process of modern shipbuilding. What Bangladeshi ship breakers have been practicing over last few decades is far from this basic principle and that is why overall standard in terms of health safety and even environment is very poor. No research work has been done so far to identify and find need based solution for up-gradation of ship breaking industry in Bangladesh. That is why, for long sustainability of this industry the following measures of Research and Development (R&D) need to be done:

Developing methodology for ship recycling industry in Bangladesh focusing on integrated scientific and technological knowledge, risk and safety analysis and socio-economical analysis.

Optimisation of infrastructure and ship recycling activities through investigating alternative processes, techniques and upcoming regulations.

Extensive environmental sampling of air, water and soil in and around ship breaking yards to investigate short term and long term impact.

The fusion cutting or gas cutting that uses the combustion of the gas is generally used for dismantling of vessel in Bangladesh. However, in absence of strict/adequate measure, heavy casualties due to gas explosion are frequently occurred in Bangladesh which is shown in Figure 5. Negative environmental impact such as toxic gases generated from the coating and CO₂ generated from combustion become a problem and a new alternative technique is needed to replace the fusion cutting method. Water jet cutting machine is one of such alternatives. Japan is trying to introduce water jet as a replacement for gas cutting [9]. In future, shiprecycling industry can be benefited by using such technology. The advantage of water jet cutting is that while cutting by high pressure water, there is no chance of explosion because it does not accompany fire and thus the improvement of work environment can be expected. It is possible to remove the coating

by adjusting the injection pressure so that the toxic gas generation can be avoided.

For downstream waste management, instead of individually creating own hazardous material removal department by each ship dismantling yard, all ship dismantling yards may outsource the IHM and waste removal to waste management unit. It will have the following benefit:

- Waste management unit will work as a part of ship recycling yards
- Waste management unit can be handled in more integrated way using the similar number of workers, specialized technical persons, common TSDF (Treatment, Storage, Disposal Facilities) etc.
- Waste management unit can be operated efficiently and cost effectively.

Shiprecycling industry in Bangladesh did not receive any grants, subsidies or tax waivers and other benefit from the govt. since it was not recognized as a industry. Now situation has changed a lot and ship breakers is expecting more support from ministry in terms of cash incentives, infrastructure development, access road development, utility service like water-electricity- sanitation facilities development etc. Technical assistance and funding from Govt. for setting up a modern laboratory is also necessary to improve environmental monitoring of shiprecycling industry in Bangladesh.

Traditionally Bangladeshi shipbreakers usually make more profit than any other shipbreaking yard in the world. Even after imposing 5% AIF (Advanced income tax) to all shipbrakers, the margin of profit is still more than 13%. Figure 8 shows breakdown of cost-profit for 21000 LDT ship broken by local yard. From this Figure, it is well understood that Bangladeshi shipbreakers are capable of investing money for infrastructure development of health, safety and environmental issues.

CONCLUSION

Ship breaking is an important activity in the economics of Bangladesh. It makes a significant contribution to the global conservation of energy and resources. From the above discussion, the following conclusions can be drawn:

- Ship recycling has become a major contributor to the development of national economy. Contribution of ship breaking to inland shipbuilding in Bangladesh is enormous.
- Well designed cutting plan focusing on technological, safety, environmental issues must be ensured to avoid labours casualties of shiprecycling industry in Bangladesh.
- Occupational health safety can be ensured by strict monitoring of governmental regulatory bodies as well as imparting extensive training to the worker and also providing personal protective clothing & equipment to the workers.

These equipments include hand gloves, face mask, helmets, aprons, etc.

- Environmentally sound and safe downstream management of hazardous waste related to ship recycling activities in Bangladesh appears to be improving than previous period. New legislation put forward by MOEF [10] could play a catalyzing effect on developments and improvement of waste management sector in shiprecycling yard. In addition, environmental monitoring needs to be strengthen through capacity enhancement of concerned departments as well as developing laboratory facilities etc. Baseline study in terms of environmental aspect should be carried out immediately to find the level of environmental pollution and remedial measures that need to be taken.
- To retain competitive edge in the long run, Bangladesh has no other alternatives but to improve the safety, health and environment aspect through significant infrastructure and capacity development and this should be based on the outcome of the research work.

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Table 1: Handling of hazardous materials in Shipbreaking in Bangladesh.

Hazardous Materials	Usual Practice in Bangladesh	Infrastructure Implementing/ to be implemented
Asbestos	Re-use for insulation in cold storage and central air conditioning system. Uncontrolled landfill is seen.	Separate chamber & temporary storage facility for handling asbestos have been implemented. Also, need secured landfill.
Antifouling materials/paint coating	No standard practice is available now. Torch cutting and re-rolling of steel are done without removing coatings.	Need to develop system that includes analysis, removal and disposal of paint through solidification, landfill in waste management system.
Waste substance and article containing Polychlorinated Biphenyls (PCB), Poly Brominated Biphenyls PBB, Poly Brominated Diphenyl ethers (PDBE), Poly Chlorinated Naphthalenes	Some PCB containing equipment and materials are re-used. In many cases, neither any standard format nor any available ways for analysis, labeling and inventory preparation is practiced.	High Temperature Incineration is implementing now in each ship breaking yard. Need capacity development in identifying, analysing & labelling of PCB materials.
Ozone Depleting Substances (ODS)	Release in the atmosphere.	High Temperature Incineration is needed with special vendor to handle ODS.
Cadmium, Chromium, Lead, Mercury	Batteries, light fittings, level switches etc reuse. In remaining case, no standard practice available.	Physico-Chemical Treatment, Secured Landfill is necessary for environmental friendly disposal.
Medical/Pharmaceuticals wastes	No standard practice available, disposed of informally elsewhere.	Need temporary waste station, landfill site.
Bilge water	Release to sea sometimes	Storage facility is implementing. Need Physico-Chemical Treatment, Landfill etc.
Compressed gas cylinders	Cylinder reused	Metal recovery by special vendor is needed.
Electrical Equipment	Re-use	Recycling, residues to Landfill is needed.
Fluorescent Tubes	Re-used in case of good condition.	Mercury/glass recovery need to be implemented.
Lead Acid Batteries	Re-use if good condition; handling of batteries accumulators seem to be inadequate.	Recycling and Physico-Chemical Treatment, Residues to Landfill etc. need to be developed.
Oils	Re-use	Recovery, Incineration is also needed.
Waste oil/Oily water	Release to sea sometimes	Oil water separator is being installed. Also Physico-Chemical Treatment is needed.
Sludges	Re-use in brick field.	Incineration facility is implementing now.