



VARIOUS ASPECTS OF SOUND SHIP RECYCLING IN SOUTH ASIA: A COMPROMISE NOT A CONFRONTATION!

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ABSTRACT

The significance of ship recycling may not even be lesser than shipbuilding. The recent studies reveal that the global disposal of ships touches the number of 7 billion LDT every year. Total percentage of ship recycling in South Asia amounting is almost more than 80% of the total figure in the world. The ship dismantling yards are not always well established. So, naturally it calls for the safety, health and environment (SHE) aspects and they are of increased attention in these industries. Thus it is a cause of concern for the world in terms of workers plight in this so-called dangerous industry. On the contrary, socio-economic state and level of living standard in the other factors are contributing to the current condition of ship dismantling industries. Low economic strength and unemployment problem leads to the lower rate of scrapping prices in these countries. The current market organization for disposing of obsolete or damaged ships does not favour improvements. Dismantling the ships in a responsible way would, under current market conditions, increase the price that the scrapper needs from the steel industry to a level, which will make ship dismantling uncompetitive, or reduces the price of a ship an owner gets for his end-of-life ship. A techno economic analysis may prove helpful to reduce the impact of the problem. Identifying problems, analyzing them from various points of view, planning a long term strategy and finally a compromise among all parties is the way forward for these very delicate and sensitive issues related to ship recycling industries in South Asian countries mainly Bangladesh, India and Pakistan. If the problems rather challenges can properly be identified and the solutions be found, an environmentally sound and safe recycling system can be established, although the current recycling condition is unfavourable for both people involved and the environment. And hence a safe & environmentally sound recycling of ships will be possible which will be economically acceptable.

Keywords: sound ship recycling, ship recycling facilities, safety, health, environment, national and international legislation, socio-economic impacts, LDT, South Asia, ship dismantling, ship disposal.

1. INTRODUCTION

Ship scrapping is a function of breaking up ships for further use in some forms. It is getting increased significance as the number of vessels to be disposed off is increasing. Every year, the shipping industry sends about 600 end-of-life ships to disposal yards.

The present paper exposes the theoretical background of the ship recycling problems and their solution matrix, analyzing different existing disposal methods with their techno-economical advantages and disadvantages. The current condition of ship recycling is not favourable for both health and safety of the people involved and for the environment. It is evident that frequent death occurs either from occupational disease from ship borne hazardous substances like

asbestos or PCBs, or from explosions, fires and other accidents.

Bangladesh is currently the largest ship dismantling country, having processed more than 60% of all large ocean-going vessels in 2007.

The environment is being affected very highly by the ship dismantling activities. Old ships contain many toxic substances, asbestos, pollutants and hazardous materials. In the ship dismantling yards in Asian countries there are no waste treatment system. The toxic substances are being released into the environment.

For the purpose of overcoming these problems, it is now necessary to find the reasons and the main bottle

necks of the problem. One of the main reasons might be the technical unavailability to deal with the situation in a responsible manner. Economic factors associated with these industries may be another reason for irresponsible ways of recycling world fleet.

2. BACKGROUND INFORMATION AND PROBLEM DEFINITION

2.1 Background

Dismantling or recycling of ocean going merchant ships has come under increased scrutiny of international organizations such as IMO [1], ILO [2], UNEP [3] (Basel Convention [4]). The main reason for this is that dismantling normally takes place under difficult conditions, both for the people involved in the actual scrapping process as well as for the environment which suffers from toxic residues which emerge and escape during this process.

The current market organization for disposing of obsolete or damaged vessels does not favour improvements in both the situation of men and environment. The latter will provide an incentive to avoid clean and safe ship breaking. Thus the additional costs of clean and safe operations form the main bottleneck in its introduction.

2.2 Problem Definition

Ships are not being dismantled as much as expected, so there are increasing numbers of old ships. One view is that the tonnage of vessels available for recycling will match actual world recycling capacity estimated at 12 million LDT per year.

Health and Safety

The ship recycling industry is one of the most deadly in the world. Workers dismantle the ships with their bare hands. Ships are scrapped by poor workers. Working condition is unsafe. They are unprotected from toxic substances, explosions, falling objects and working condition hazards and accidents. Machinery parts, oil rags, open fires and leaking barrels are all over the beach including asbestos. Workers with torch cutters dismantle the huge sea-carriers.

Environmental Pollution

Old ships contain a lot of toxic substances and other hazardous materials. The vessels are broken on Asian beaches and along rivers. The toxic substances are released into the environment. The soil, sea, rivers and air are heavily polluted.

2.3 State of Industry

Existing Recycling Procedures

There are no recycling facilities at all in the South Asian countries. Pristine beaches are being used to

break the huge vessels. No docking facilities.

Ships are dismantled by poor workers earning between US \$1.5 and 2.5 a day. They break the ships with torch cutters and their bare hands - unprotected from toxic substances, explosions and falling steel. Well over 100,000 men and women work at ship dismantling yards worldwide. They are desperate for a job. Unknowingly they dry asbestos plates in the sun and sell the pieces. Even in their sleeping quarters the toxic substances are all over the place.

Most of the ships dismantled today were built in the 1970s. That is to say prior to the banning of many hazardous materials. On the Asian beaches, these toxic substances are released into the environment and the workers bodies.

2.4 Typical Hazards

Fire and Explosion

In recycling yards in Asia rarely a ship is cleaned properly or gas freed before it is dismantled. The workers are not trained and aware of fire and explosion.

Toxic Substances

In Europe hazardous substances are subject to special monitoring. The disposal is highly regulated. But at the ship breaking yards of Asia waste is burned in the open area. They cause fumes with very dangerous dioxins and PAHs (Polycyclic Aromatic Hydrocarbons). These are so called Persistent Organic Pollutants (POPs). The typical toxic materials found on board ship are POPs (Persistent Organic Pollutants), PVC, Dioxins, PAHs, Organotins, PCBs, Asbestos.

Heavy Metals

Shipwrecks are big heaps of 'toxic scrap', built with lots of materials that contain toxic substances. Heavy metals can be found in paints and coatings. They are also in anodes, insulation, batteries and electrical compounds.

2.5 Regulatory Bodies

For the better understanding of safe and environmentally sound disposal/recycling, it is necessary to review existing regulation. Following are the regulatory bodies in the subject area.

International Maritime Organisation (IMO)

The IMO is the United Nations body that regulates the shipping industry.

Green Peace

Green Peace lobby group has a rational view of recycling but may not always offer practicable or

economic solutions. The issue of ship breaking has been brought to the attention of IMO, and Green Peace [5] is the leading lobby group in this area. Often it is dominated by Flag of Convenience (FOC) countries, whose first interest is to get high numbers of ships in their ship registry.

Basel Convention

The Basel Convention (1989) was initiated by the UN Environmental Programme. Under it, exporting nations and polluting industries have to take care of their own toxic waste. This promotes a shift to clean production. The Convention places the onus on the exporting countries rather than on the importers.

EWSR

The EU regulates the export of waste in the European Waste Shipment Regulation (EWSR [6]) or Council Regulation 259/93/EEC. This incorporates the Basel Convention.

International Labour Organization (ILO)

International Labour Organization is the most important body to concern about the welfare of workers, their safety and health. ILO also has its role in ship breaking. It has published "Safety and health in ship breaking: Guidelines for Asian countries and Turkey".

2.6 Market Review and Cost Consideration

There is an urgent need to generate ideas for the development of an economic system that would result in a safe and environmentally sound system of ship recycling. An estimation of the costs of environmentally sound recycling is essential in the introduction of such a financing system. Scrap price and demand are the main factors, which influence the scrap market. Scrap price trend shows that it was always increasing in the past although there is a downward trend in the recent years. Scrap demand in the dismantling nations is still high in line with the population growth and other socio-economic change in condition.

Cost of dismantling is another factor leading to the decision making process of the scrapers. If the cost of the total process is higher than the profit gain no one is interested to step into it, doing it in a proper manner is far more unrealistic. The total cost of dismantling a ship can be the sum of operational cost and labour cost. Labour costs in the Asian countries are relatively much lower than western countries. And probably due to the stringent labour, environment and safety regulation in western countries has stimulated a geographical shift of recycling activities to the less developed countries. But labour cost is dominant as the dismantling process is highly labour intensive.

Future trend of the scrapping activity can be assumed to be inclining as the number of ships to be

scrapped is increasing. Price of steel scrap is also to see rise due to the increasing demand of steel and steel price. So it is obvious that the ship recycling activity in no doubt is existing strong. But the concern is it needs to be done in a safe way and without harming the environment which incurs cost. Hence a detailed economic analysis is necessary to suit the safe and environmentally sound recycling to the existing scrapping function.

3. SHIP DISPOSAL

3.1 Where and Why

The ship recycling industry has been historically footloose industry. The ship recycling industry is concentrated in a very limited number of countries and those countries level and state of economic development makes it an activity that suits their needs perfectly.

It has in the past moved from Europe to the Far East, in particular to Taiwan, from where it moved on to the current four foremost ship breaking nations: India, Bangladesh, Pakistan and China. These four countries handle an estimated 85% of the world scrap tonnage in terms of light ship weight.

The reasons why ship disposal takes place in those regions of the world are as follows: 1. Sea access, 2. Scrap demands, 3. Unemployment problems, 4. Low cost of dismantling, 5. Lack of safety standards, and 6. Lack of environmental control.

3.2 Significance of the Problem

Ships are not being scrapped as much as expected, so there are increasing numbers of old ships. The tonnage of vessels available for recycling will match actual world recycling capacity estimated at 12 million LDT (Light Displacement Tons) per year.

At the end of the decade (2010) some 4,000 ships with an aggregate gross tonnage of 24 million should be recycled every year. The replacement of 4,000 ships per annum with an aggregate gross tonnage of 24 million by the year 2010 may result in a littering of the oceans, beaches, rivers and ports if these ships are not recycled in a responsible way [5].

3.3 The Problems Associated with Disposal

The problems arising within the major ship recycling nations are concentrated around three themes: Safety, health and Environment.

Safety and Health of People Involved

The most important concern about ship dismantling is safety of human being involved in the dismantling process. Hundreds of people at the ship recycling yards endure hard physical labour. They work in

permanent danger. Accidents are very common in the scrapping yards. On board gasses cause fires and explosions. Main causes of death are fire/explosion, hit by materials falling, falls from height, suffocation and inhaling CO₂. The following table shows an overview of high rate of accidents in the dismantling process.

Table 1: No. of major and minor accidents in Bangladesh ship breaking yards

Statement of accidents by ILO in twenty ship breaking yards in Bangladesh

Year	Minor Accidents	Major Accidents	Fatal Accidents
1996	147	21	2
1997	201	10	5
1998	203	11	0
Total	551	42	7

Source: ILO Report on ship scrapping [2]

The following hazardous conditions are commonly observed in a ship scrapping yard

- Fire and explosions
- Toxic substances
- Hazardous materials
- POPs, PVCs, Dioxins and PAHs
- Organotins, PCBs and Asbestos
- Falling from heights and falling objects
- Working condition hazards and accidents
- Environmental pollution and contamination

Costs

The problem is one of cost –Disposal costs are high. Due to risk associated with the ship recycling and uncertainty of the business investors are not interested to invest.

Lack of Rules and Regulations for Implementation

Hazardous waste materials from the ships are widely distributed. In most ship breaking nation's proper waste management is absent. There are no rules and regulations. And if there are, very often there is a great lack of control.

Role of IMO in Ship Recycling

International treaties can help protect the environment and the workers' health. In March 2002 it started to debate its role in ship breaking. IMO Regulations on Ship Recycling are as follows:

1. Green Passport
2. Phase out of single hull oil tanker
3. Prior cleaning before dismantling

4. CURRENT RECYCLING

Different dismantling models exist depending upon the local industrial and economic environment, the mechanical level, available equipment, infrastructures and the outlet markets for recoverable products, secondary raw materials that are collected from recycling. Basically, three types of dismantling can be defined globally: 1. The Non-mechanised process [8], 2. The Highly mechanised process [8] and 3. The Intermediate Process [8].

Each of these types varies in relation to secondary characteristics, infrastructures and outlet markets for recoverable products. However there are economic and human aspects which appear to be universal.

4.1 The Non-Mechanised Process

This is a labour-intensive process. This process uses a strong labour force, which is found in the Indian subcontinent. This type of process is found in a social and economic environment offering abundant, cheap labour and within a civil society that is little sensitive to the social and environmental aspects of this activity and of other industrial activities in general.

The low level of economic development does not allow the acquisition and maintaining of costly, energy-consuming mechanised means. Same reasons hinder the building of new infrastructures (slipways, graving docks, waste collection, treatment networks and transport links).

The ships are progressively cut into vertical sections using blowtorches, starting with the front parts and the ship sections are then gradually hoisted onto the shore away from tide waters. These sections are subsequently cut into strips of metal which can each be carried by a team of twenty or so workers having no handling equipment, these strips being sized mostly to meet the requirements of the re-rolling workshops located in direct, close vicinity of the dismantling site.

This industrial process starts by grounding the ship on the shoreline, if possible benefiting from an exceptionally high tide so as to place the working area away from the effects of rising and ebbing tides. Simultaneously with the disembarking of all equipment and materials which are easy to handle, the front of the ship is cut with a blowtorch on the beach itself by a strong labour force. The dismantling of the ship then progresses in vertical sections towards the stern of the ship. The sections that have been cut are brought higher up onto the beach so that cutting can be completed into smaller parts.

The work in these places is conducted under high temperature conditions, but the temperatures are not high enough to the destruction of pollutants which

still remain on the scrap metal. The conditions are similar to forge working conditions. Workers work with no protection means for their safety and health. The steelworks are not all equipped with fume separation or filtering installations capable of trapping these pollutants. This scrap is treated in the same way as common land scrap. As a result, this entire non-mechanised process generates high environmental and social affects which are neglected by the economic players concerned since they do not directly have to take these in charge.

4.2 The Highly Mechanised Process

This process uses a small labour force, which is found solely in Western countries.

This type of highly mechanised process may be in an economic setting in which labour is expensive, and in which health, safety and environmental requirements are important by all economic players concerned. Dismantling does not require either heavy investments (with the exception of acquiring and adapting a site) or highly skilled labour. This labour does need to have specific experience which is achieved by several successive ship dismantling operations. This knowledge is a combination of industrial demolition techniques and shipbuilding techniques.

The actual dismantling operation can be initiated through the rapid use of mechanical means for horizontal cutting of the ship, so that large metal blocks can be removed by crane onto a quayside of the dismantling site. The employment of cutters armed with blowtorches is just reserved for situations where large mechanised means are not applicable. The dismantling process is interrupted whenever necessary to take general protective measures.

The end non-recyclable wastes are isolated from the recycled metals in the same way as land scrap treated in the electric furnaces. The environmental, social and human reliability of this entire process is based on the standardised work methods, employing a reduced number of operators and using equipment which is able to control environmental and human risks.

4.3 The Intermediate Process

This process uses some equipment but still maintaining a significant labour force, which can be found in Turkey, China or even at some dismantling facilities in the United States.

This type of process, which employs abundant relatively cheap labour, also uses mechanised equipment. This model is based on the existence of low-cost national or immigrant labour. The dismantling methods are manual, but the partial use of equipment such as cranes overcomes the need for

heavy handling work and extensive manual cutting of the ship, thereby reducing risks and the harshness of work conditions.

Additionally, the existence of specifically built slipways or wet berths allows the use of standardised, stable methods allowing better safety of worker and the environment. This economic model remains viable in a social environment whose standards of worker protection and environmental protection are close to European standards (Turkey, USA). In this type of dismantling process, the general location and infrastructure is almost same as in highly mechanised Western dismantling sites. This type of process tends to treat pollutants and hazardous substances in order to reduce the impact on the environment and on workers' safety. The fact that practically no direct conversion facilities exist for recovered metals. This reduces the dismantling times and initial cleaning phase.

The steps of this intermediate process start with an inventory to list the hazardous substances on board. The ship is then taken to an industrial site having the necessary infrastructures (quayside, slipway, wet berth). Dismantling is essentially manual (using blowtorches), proceeding in horizontal layers similar to the method used in the highly mechanised process. Non-accessible hazardous materials which could not be removed during the initial phase are removed as and when demolition progresses. The remaining bottom shell of the ship is cut manually in vertical sections, either in an insulated wet berth or on a slipway after pumping off effluent.

This intermediate process involves the direct reuse of some equipment recovered on board, but not in a manner as in the Indian subcontinent. On the other hand, practically no direct reuse is made of secondary raw materials, which means that all the scrap is directed towards large electric steelworks to undergo a complete cycle which provides a better guarantee for the removal of waste still remaining on this scrap.

5. ECONOMIC ANALYSIS

The purpose of this study is to give an overview of economic issues involved in a safe and environmentally sound system of ship recycling. The economic phase of a recycling system can be divided into the following categories: 1. Cost consideration, 2. Market review and 3. Future trend

5.1 Cost Consideration

An estimation of the costs is essential in the introduction of such a safe & environmentally sound scrapping. This study helps to estimate the additional costs of environmentally sound scrapping. The following costs are associated with the safe recycling:

1. The costs for removing structural components
2. The costs for removing operational waste
3. The costs for increasing the capability of the ship recycling yard
4. The costs for adjustments at the ship recycling yard to deal with the on-board generated waste.

But, any additional cost involved can be handled by means of the following:

1. Increasing recycling instead of scrapping as much as possible.
2. Increase the price of ship to be scrapped.
3. Raising ship recycling fund.
4. Increasing productivity- A well developed recycling yard is more profitable

Ship recycling fund is to be contributed by the ship owner at the operational life of ship as the responsibility of safe recycling goes to the ship owner itself.

5.2 Market Review and Future Trends

Scrap Demand and Price

It can be seen from the trends presented below that although the recent scrap price in some countries are in a down turn, the demand of scrap is still significant. A little reduction in scrap price now might be due to the recent decline in the world economy. But it may not be the same in the near future as was not in the past.

Available Number of Ships to be Recycled

Ships are not being scrapped as required. Huge numbers of vessels are waiting to be scrapped.

According to E.A. Gibson Shipbrokers [7], ship owners extract an average US\$ 1.9 million per End of Life Vessel. Every year around 600-700 larger sea vessels are taken out of service and brought to scrapping yard. In the 1990s they had an aggregate tonnage of around 15 million dwt a year. However, the scrap market increases and will increase substantially the following years. In 2001 the total 608 numbers of vessels were sold for scrap already totalled a figure of 28 million dwt. This marks a year on year growth of nearly 25%.

Future Trends

Current costs estimations are linked to ships on the scrapping market which have been built 20 to 30 years ago. Ships becoming available for scrapping in the future might show a different cost pattern as technical developments have progressed. Market information indicates that cost reductions are not expected to be large at the short term. However, current initiatives aimed at building cleaner ships and

introducing recycling regulation might lead to substantially lower costs for environmentally sound scrapping. These costs reductions are on the long term basis only (some thirty years from now).

6. POSSIBLE SOLUTIONS

6.1 Implementation of Ship Recycling / Disposal Regulations

Various Local and International regulations are in effect worldwide. Those regulations are based on the analysis of past and current recycling system and focused to protect the life of workers and prevent the environment from pollution. If the rules and regulations are implemented, the safe and environment friendly recycling can be achieved.

IMO is the role playing in the international context. It has come out with the concept of Green Passport to minimize the hazardous substances on board ship and prepared the guide lines on ship recycling. ILO came out with "Safety and health in ship breaking: Guidelines for Asian countries and Turkey". The other significant organisations relevant to ship recycling are EWSR and Green Peace. United Nations UNEP is in action from the Basel Convention for control of hazardous wastes and its disposal which is applicable in the ship recycling industries.

Port State Control will play a role in checking on what ships contain, so that cleaning and disposal can be planned.

6.2 Developing Recycling Facilities

Design of Ship Recycling Yards

As in the case of design for recycling, it is now possible to design safe and environmentally sound recycling facility. A number of concept designs can be introduced depending upon the type of ships or structures to be recycled, since there are not many changes in future design.

Design of Recycling yards to conduct safe, environment friendly and economically profitable recycling operations can be developed.

1. For the future, it is difficult to see changes in ship design. The ship has to be watertight and meet strict requirements such as port restriction and canal regulation.
2. Bans on hazardous materials are in place.
3. In operations, there are requirements for maintenance to ensure the ship is not hazardous.

A well developed recycling yard is normally equipped with the necessary equipment for the operation and with necessary facilities to deal with

the hazardous wastes in a responsible manner. In good scrapping yards workers are well protected against hazardous materials. These may ensure the safety of the people & also help protect the environment. There should have a waste reception and treatment facility.

A simple recycling yard with waste reception facilities and only two cranes for material lifting, using beaching method may take a view of the figure below.

6.3 Safe Practice to Protect Workers and Environment

By introducing safe working practice, it is possible to minimize the rate of accidents. In a recycling yard in South Asia currently there is no standard practice of recycling. Introduction of standard work practice which is suited for the current facilities will not increase the cost very much. This standard work practice may consist of a set of procedure of recycling which include the following:

1. Recycling plans
2. Methods of work
3. Step by step work details
4. Heavy lifting procedures

Safety and environment management systems suitable for the particular scrapping yard which will establish safe working procedures and assure the safe working condition. This can be done by introducing a permit to work system where any hazardous work commencement requires a permit issued by relevant and appropriate body such as certificate for hot work, permit to entry into confined space etc.

In good scrapping yards workers are well protected against hazardous materials. Protective clothing, hand gloves to prevent hand injuries, use of face mask to protect from fumes and gases, hard hat/ helmet to protect head, safety boot can protect legs from injuries, safety goggles to protect eyes and ear plug to prevent from hearing losses.

Training of the workers is very important phase of the safe practices of the scrapping yard. They should be trained to follow a plan of work, and use protective appliances and to know how to work safely.

There must be proper waste management to prevent contamination of the environment. The enforcement of the use of protective clothing and working appliances should be present in the national level. The appropriate and relevant government body has to perform checks to the recycling yard whether the implementation of safe work procedure is present and use of protective appliance is in practice.

6.4 Ship Design for Recycling

Ship design for Production and Operation is existed in ship design. Ship designs for Safe Recycling can also be developed since it is difficult to see changes in ship design in the future. Ship has to be designed following strict requirements. Cars are designed for disposal. Similarly ship can be designed considering safe and sound disposal or recycling.

The shipping industry must build clean ships without toxic materials. Ship can be designed for easy dismantling without health and environmental risks. Encourage naval architects and shipbuilders to take due account of the ship's ultimate disposal when designing and constructing a ship by doing the following:

1. Using materials which can be safely recycled
2. Minimizing the use of materials known to be potentially hazardous to health and environment
3. Limiting the use of composite materials such as sandwich panels which are difficult to recycle
4. Taking measures to facilitate the removal of such materials

Recycling is more economic than disposal. Cars are designed for disposal. Ships also can be designed for recycling. By applying this concept disposal risk to human and environment pollution can be minimized.

6.5 Owners Approach

The shipping industry is responsible for its own vessels. They should take immediate measures to prevent pollution of the environment and protect the workers that dismantle their ships. They can do that by decontaminating and degassing their ship-for-recycle before sending to dismantling yards.

Ship owners can help recycling their ship in safe and sound way. They need to maintain ships as clean as possible. Prior cleaning before sending the ship to recycling yards is important and should be done by the ship owners in operation. Ship owners should also gradually make their vessels still in operation cleaner. During maintenance and survey ships, hazardous materials should be replaced with clean alternatives. A list of hazardous materials found on board ships to be included.

6.6 Inventory

An inventory of all materials on board ship will help the recyclers to take necessary precaution for recycling. The knowledge of the hazardous material present will help them planning operation in safe and sound way. Before sending the ship for dismantling, ship owners should clean their ships of hazardous materials and present a complete inventory of the remaining hazardous materials to recycling yards.

6.7 Disbursement of Funds for Environmentally Sound Ship Recycling

Currently the ship breaking yards are not established for environmentally safe recycling. Development of recycling yard is costly. To help development of yard or adjustment to current yards ship recycling fund can be raised. Ship owners and relevant national and international bodies can contribute to the fund.

6.8 Financing R&D on Clean and Safe Ship Recycling

Research & Development of recycling will help improve the current condition in this sector. R & D should be financed too. The ship recycling fund can be used to support R & D activities.

7. CONCLUSIONS

It is true that the contribution of ship recycling industries to the environment pollution and human health is significant. The current problem is complex and cannot be solved overnight. It will take time. The risks and associated effects on the environment can be minimized.

1. Implementation of ship recycling regulation is one of the solutions. For example green passport concept will minimise the use of hazardous material for shipbuilding and an inventory of all materials on board will help safe and environment friendly recycling. Other regulations such as wearing protective clothing and waste treatment before releasing into environment are to minimise accidents and prevent environment pollution. But the current regulation demands a drastically change in the situation which is not practical. It has to be enforced gradually.
2. Ship design for recycling is another solution to this problem in the long run. That is it can be helpful some 30 years or later. If a ship is built today giving consideration for recycling it will have to be recycled some 25 to 30 years later. So ship design for recycling concept is for the future. It does not solve the current problem.
3. The other solutions e.g. facilities development, safe practices may prove helpful if some form of subsidy or funding is provided, although a huge investment is not practical. Practice of safe procedures is the most important to address the current problem. It requires minimum effort both with respect to technical consideration and economic practicability. Suitable practices can be regulated by the national and international bodies. Certification of recycling yards and control of working practices, creation of an inventory for

the new ships and the ships in operation can be regulated.

4. However an initial financing is required. Disbursements of funds and research and development have to be financed. Financing can be made in a variety of ways locally and internationally by shipping industries as well as with the help of the environmental agencies. Initialisation can be in a small scale and then grown slowly.

Although the current situation is unfavourable, ship recycling can be green industry if everybody concerned comes forward to it. Changes can only come about if it is a mutual desire and there is much hope that there will come a day when the horrible image of the ship recycling can be forgotten and the new age of clean and green ship recycling will be the future of a dream come true.

ACKNOWLEDGEMENT

The Author is extremely grateful to the following ex-students Mohammad Shariful Alam [8], Jerri Ealham [9] and Sasheena d/o Thanasingam [10] of School of Marine Science and Technology (MAST), University of Newcastle upon Tyne, Newcastle University Marine International (NUMI) - Singapore for their works of final year projects.

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