Ship Breaking Activities and its Impact on the Coastal Zone of Chittagong, Bangladesh: Towards Sustainable Management

Dr. Md. M. Maruf Hossain
Mohammad Mahmudul Islam
Institute of Marine Sciences, University of Chittagong,
Chittagong-4331, Bangladesh.

Published by

Advocacy & Publication Unit
Young Power in Social Action (YPSA)

First Published :
July 2006

Reviewed by :
Professor Shafique Haider Chowdhury

Coordinated by :
Muhammed Ali Shahin

Assistance :
Md. Sirajuddin Belal
Abdullah Al Shakir

ISBN : 984-32-3448-0

Citation :
Md. M. Hossain and M. M. Islam. 2006. Ship Breaking Activities and its Impact on the Coastal Zone of Chittagong, Bangladesh: Towards Sustainable Management. Young Power in Social Action (YPSA), Chittagong, Bangladesh. pp ix + 54

For Contact & Comments :
Dr. Md. M. Maruf Hossain
E-mail : marufctgu@yahoo.com

Design & Printed by :
ICO, 1 CDA C/A, Momin Road
Chittagong, Bangladesh.
Tel : 031- 611934

Published by :
Advocacy & Publication Unit
Young Power in Social Action (YPSA)

House # F10 (P), Road # 13, Block-B, Chandgaon R/A, Chittagong-4212, Bangladesh
Tel. & Fax +88-031-672857, 88-031-2570255
Cell: +88-0189-321432, 01711-825068
E-mail: info@ypsa.org, shipbreaking@ypsa.org
www.ypsa.org

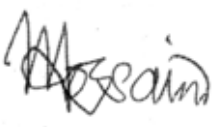
Preface

This volume originated in the form of research report commissioned by Young Power Social Action (YPSA). I, on behalf of the authors, would like to thank all those who assisted and cooperated in accessing the relevant data and literatures. I particularly wish to record our earnest thanks and appreciation to Mr. Md. Arifur Rahman, Chief Executive, YPSA for all his help and cooperation for the whole activity. Needless to say, the resultant publication would have not been possible without the kind support of YPSA. Sincere thanks & gratitude to Manusher Jonno Foundation for their cooperation.

Our heartfelt appreciation accorded to Professor Shafique Haider Chowdhury, former Chairman, Department of Zoology, University of Chittagong, for his scholastic and peer review of the whole document. Sincere thanks also due to Mr. Muhammed Ali Shahin, Program Officer of YPSA for all his encouragement and extending cooperation from beginning to end of this work. Valued and sincere assistance received from all other staffs of Advocacy & Publication unit, YPSA are also welcome.

The study would have not been possible without the generous support of the labour and local people, including representative from different classes of people, of the ship breaking yards. We are grateful to them. We also like to thanks President and other officials of Bangladesh Ship Breakers Association (BSBA) for their cooperation and help during our study period and visit to ship breaking yards.

This study makes no claim of exhaustive. Our modest purpose has been to offer handy and easily accessible sources of information and references to any one interested to ship-breaking and relevant matters, with a number of recommendations and suggestions for an eco-friendly and long sustaining ship breaking activities in Bangladesh. Finally, we will feel highly rewarded, if this work is found as a background document to pave the way for further investigation into this interesting and crucial area of study and to support formulation of a sustainable and environment-friendly policy for ship breaking activities in Bangladesh.



(Dr. Md. M. Maruf Hossain)
Professor
Institute of Marine Sciences
University of Chittagong, Bangladesh

Foreword

In the context of increased importance of ship breaking activities in Bangladesh, specially contribution to construction & structural development (>80%); and in national economy & employment opportunity for the poor. But indiscriminate and haphazard ship breaking activities in once pristine intertidal and biodiversity rich coastal area of Sitakunda, Chittagong is now a barren field. The area is severely degraded with loss of its physical, chemical & biological characteristics. There is very little information on the present status of biodiversity in the area and impact of ship breaking on fisheries and biodiversity. Verbal reports from fishermen indicate that there is a drastic reduction in fish catches which is likely to be due to this ship breaking activities.

Ship breaking activities has not yet been recognized as 'industry' and still there are no separate guidelines or rules for ship breaking activities in Bangladesh. As a result, there is often accident, loss of valuable human lives & serious violation of human rights & labour rights, including very low wages. On the other hand, impact of ship breaking on the biodiversity is also matter of exploration. But to assess the impact of ship breaking on biodiversity & fishery resources, a research or study is urgently needed not only for the conservation of fishery resources but also to implement a sustainable & eco-friendly policy for ship breaking in Bangladesh.

From this point, authors made a timely and demand-driven attempt by compiling available relevant data, information and studies on ship breaking, its present national & global status, history, hazardous & toxic substances involved with ship breaking activities, impacts on aquatic biodiversity, human health & other resources. I hope, this work will serve as a base line information for the researchers and academicians, relevant govt. officials and policy makers, media peoples, businessmen & owners of ship breaking association, NGO's, law maker's and interested public.

The language and style of presentation are lucid, and oriented, not only to specialists but also to general readers. In addition to comprehensive abstracting of the major literature, this book also contains suggestive agenda of possible research on 'loss of biodiversity & fishery resources' due to ship breaking activities, and suggestion for implementation of a sustainable and eco-friendly ship breaking procedure for govt. policy makers and ship-owners.

I congratulate the authors for taking up this valuable and well-timed, demand needed project; and for their untiring zeal towards compiling various literature in an orderly fashion. I also congratulate the reviewer, Professor Shafique Haider Chowdhury, for his scholastic review of the draft manuscript. I would also like to offer sincere thanks to all the personnel of YPSA, specially my proactive colligues of Advocacy and Publication Unit, YPSA, for all of their effort to publish the document.

I am highly indebted to Manusher Jonno Foundation (MJF) for all of their technical support, guidance and encouragement for publishing the document successfully.

Finally, I believe that, this work will make a substantial contribution in highlighting the issue of ship breaking for an effective management and thereby go a long way in saving our highly valuable fishery resources –the main sources of protein & our future, with a vision of long term eco-friendly and sustainable ship breaking in Bangladesh.

(Md. Arifur Rahman)
Chief Executive
YPSA

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BELA	Bangladesh Environmental Lawyer's Association
BOD	Biological Oxygen Demand
DNV	Det Norske Veritas
DO	Dissolved Oxygen
EPA	Environmental Protection Agency
FIDH	International Federation for Human Rights
ICS	International Chamber of Shipping
ILO	International Labour Organization
IMO	International Maritime Organization
OECD	Organization for Economic Cooperation and Development
OSHA	Occupational Safety and Health Administration
PAHs	Polycyclic Aromatic Hydrocarbons
PBB	Polybrominated Biphenyl
PCB	Polychlorinated Biphenyl
PCN	Polychlorinated Naphthalene
PCT	Poly Chlorinated Terphenyl
PHC	Petroleum Hydrocarbons
PIC	Prior Informed Consent
POPs	Persistent Organic Pollutants
PPE	Personal Protective Equipments
PVC	Polyvinyl Chloride
SBN	Set Bag Net
SHED	Society for Human and Environment
UNCLOS	The United Nations Convention on the Laws of the Seas
UNEP	United Nations Environment Program
YPSA	Young Power in Social Action

1. Introduction

Ship breaking is the process of dismantling an obsolete vessel's structure for scrapping or disposal. Conducted at a pier or dry dock or dismantling ship, it includes a wide range of activities, from removing all gears and equipment to cutting down the ship's infrastructure. Ship breaking is a challenging process, due to the structural complexity of ships and the many environmental, safety, and health issues involved (OSHA, 2001).

Ship breaking activities are being practiced in the coastal areas of Bangladesh and has gained importance in the macro and micro-economy of poverty stricken Bangladesh. Increasing demand of raw materials for re-rolling mills and other purposes and negative impacts on our coastal environments, ship breaking activities present both challenges and opportunities for coastal zone management in a holistic manner. These activities exemplify both the potentialities and the dangers of an increasingly globalised economy.

Fig.1 Ship breaking activities of Bangladesh initiated in 1969 (Photo: Reichmann, 2005)

This activity began in 1969 and since then it has earned a good reputation for being profitable but at a great environmental cost. Various refuse and disposable materials are being discharged and spilled from scrapped ships and often get mixed with the beach soil and sea water which in turn has a negative impact on our coastal environment and biodiversity.

Moreover, accidents are normal phenomena in the ship breaking yards. Over the last 20 years more than 400 workers have been killed and 6,000 were seriously injured. Due to unconsciousness and lack of government patronization, the activities are facing several internal and external problems (YPSA, 2005). Considering all these facts, a distinct and well-balanced policy is necessary for sustainable ship breaking activities.

2. Ship breaking activities in the world

Of the approximate 45,000 ocean-going ships in the world about 700 (1.55%) are taken out of service every year (FIDH, 2002). At the end of their sailing life, ships are sold, so that the valuable steel -about 95% of a ships' mass, can be recovered (Greenpeace, 2005). Until the 1960s, shipbreaking activity was considered as a highly mechanized operation that was concentrated in industrialized countries - mainly the United States, the United Kingdom, Germany and Italy. The UK accounted for 50% of the industry-Scotland ran the largest shipbreaking operation in the world. During the 1960s and 70s, ship breaking activities migrated to semi-industrialized countries, such as Spain, Turkey and Taiwan, mainly for the availability of cheaper labour and the existence of re-rolled steel market.

From early 1980s to maximize profits ship owner's sent their vessels to the scrap yards of India, China, Pakistan, Bangladesh, the Philippines and Vietnam, where health and safety standards are minimal and workers are desperate for work. It is estimated that over 100,000 workers are employed at ship breaking yards worldwide. Though 79 nations in the past decades have had some form of ship recycling activity, the Asian yards, which took off in the 1980s, now account for over 95% of the industry. Alang, in India, has retained its position as the world's largest scrapping site for ocean going ships, accounting for an average of 70% of tonnage, and an average of 50% of worldwide demolition sales. Bangladesh retained second position after India in terms of volume of recycling (FIDH, 2002).

The factors behind migration of ship breaking activities to Asia are of varying nature:

- Low paid available labour force, as ship breaking is a labour intensive industry relying on unsophisticated techniques.
- Relatively less concerns on environmental and social standard.
- A lucrative local domestic market for steel and other scrap material. For instance, the yards now supply 80-90% of Bangladesh's steel. In India, it accounts for 15% of the country's total steel output, at about half the cost of regular furnace-based plants.
- Suitable climate in which shipbreaking can take place most of the year, and an infrastructure to transport the scrap to its market place.
- A convenient geographical location: the proximity of the main eastbound trade routes has been an important factor in the development of the South-Asian shipbreaking industry.
- Another element to be taken into account is the exchange rate movements, relative to the US dollar and to the currencies of other shipbreaking nations (FIDH, 2002).

i. India

In India ship breaking activities are carried out in Alang, a coastal town in the state of Gujarat. The yard is located on the Gulf of Khambat, 50 kilometers southeast of Bhavnagar. This place has the best continental shelf available for ship breaking in the whole of Asia. At the same time, it is known for the highest tidal level (10 meters) in the country. The vast expanse of intertidal zone gets exposed during ebb tide, which makes it expedient for ship breaking activities, whereas the high tide makes it possible to accommodate big ships.

Ship breaking activity at Alang started in 1983. Today Alang boasts the biggest ship breaking yard in the world with 182 plots carrying on this activity all year round. Before ship breaking began there in June 1983, the beach at Alang was unspoiled and well preserved. It is now

considered as toxic hotspots contaminated with hazardous substances. Large supertankers, car ferries and container ships are beached during high tide, and as the tide recedes, hundreds of manual labourers dismantle each ship, salvaging what they can, and reducing the rest into scrap. Tens of thousands of low-paid jobs are supported by this activity, and millions of tons of steel are recovered (Alang-Wikipedia, the free encyclopedia www.wikipedia.com).

ii. Pakistan

Gaddani complex, a 10-mile stretch of sand-turned-junkyard, west of the port city of Karachi is the hub of ship breaking activities in Pakistan. Labour organizations have denounced working conditions at Gaddani, and international environmental groups like Greenpeace fear, the re-bound in ship-breaking will be a catastrophe for the ecosystem along the Arabian Sea coast. But labourers by the hundreds have begun turning up from all over Pakistan, hopeful that more floating behemoths will find their final resting place here. They work for $2-$3 a day, in line with Pakistan's average wage, with no safety gear and no health plan — and they are thankful to have the job in a country, where unemployment is rampant (Greenpeace, 2005).

iii. Turkey

Aliaga is the main ship breaking site of Turkey around 50 km north of Izmir at the Aegean coast. Although Turkey is an OECD country, the environmental and working conditions are very similar to other ship breaking countries in Asia. Shipbreaking in Aliaga began in mid 70's and officially in 1984, when the import of ship for scrap was allowed according to liberalization measures of that time. In Turkey the import of toxic ships for scrap is not allowed (Greenpeace, 2005).

iv. USA

In USA ship scrapping is done in controlled way in the Marine dockyard of Brownsville, Texas. To ensure sound practices of ship breaking activities, the Occupational Safety and Health Administration (OSHA) of USA issued a directive designed to ''reduce and eliminate the workplace incidence of hazards associated with ship breaking operations''. Most such activities in the U.S. involve Navy and Maritime Administration vessels. According to the Department of Labour's Bureau of Labour Statistics, shipyard operations have one of the highest injury and illness rates of any industry in the U.S. The U.S. Environmental Protection Agency has issued additional environmental and worker protection guidance for supervisors at ship breaking facilities.

v. China

In China, ship breaking looks less dramatic than on Indian or Bangladeshi beaches. Vessels are broken up in docks with more cranes and machinery. But in fact the working conditions are similar in ship breaking yards all over Asia. In China, ship breaking is mainly concentrated in the following four yards.

1. Chang Jiang Shipbreaking Yard, operated by the China National Shipbreaking Corporation in Jiang Yin, on the Yangtze river, China,

2. Zhangjiagang Yuanwang Iron & Steel Co. Ltd, Deji, on the Yangtze river, China,

3. Gujing Shipbreaking Company, Xinhui City. Guangdong Province (Joint venture by Xinhui City and China State Shipbreaking Company), on the Pearl river delta, China,

4. Shuangshui Shipbreaking Company, Xinhui City. Guangdong Province, on the Pearl river delta, China (Green peace, 2001).

vi. The Netherlands

The Netherlands is an OECD country, in which ship breaking is carried out in a strictly controlled and environment friendly condition. The ship to be scrapped is only considered to be safe after the gas and asbestos-free certificate has been issued. A ship planned for scrapping must first be inventoried by a company specially certified to inventory asbestos. A company with a special certification for asbestos removal must then remove the asbestos, after which the asbestos waste is checked and disposed of in a controlled facility. There are also strict regulations governing the removal of asbestos, such as the use of specific breathing equipment and that the work must be carried out under so-called containment. Finally, a duly accredited laboratory must issue an asbestos-free certificate. Before the asbestos free certificate is issued, the asbestos areas are inspected visually and the air is sampled for asbestos fiber. The ship is only considered to be safe for scrapping after the asbestos-free certificate has been issued.

In the Netherlands risks of oil pollution are minimized by the regulations accompanying an environmental protection license. The regulations deal, for example, with the scrapping of ships on impermeable slopes, the installation of oil drains as well as water-oil separators and provisions for the controlled disposal of oil (Fig. 2). Fires and explosions are minimized because ships are decontaminated of all fuel and residues prior to scrapping. Copper is recovered from insulated cables by a mechanical process and not by burning them. The waste products are subsequently disposed of or further processed by licensed processing companies.

Fig. 2 In Netherlands: oil drain below scrap slope prevents oil pollution (Greenpeace, 2001)

The paper-insulated ground cables are processed by the processing companies through four fractions after which possible PCB-containing fractions, such as paper; jute and bitumen are transported to controlled disposal sites. If ships are scrapped, as is often the case in the Netherlands, using other methods (with hydraulic cutters) rather than torch cutting, the problem of generating smoke, fumes and particulates that may have toxic effects does not occur. In addition, workers are protected because they are relatively far away from the surface being cut.

The Dutch breaking yards must have water-proof floors to prevent contamination of ground water. Important categories of hazardous wastes including waste containing oil and ordinary waste are sorted. This waste must be delivered to appropriate processing companies (Greenpeace, 2001).

3. History of ship breaking activities in Bangladesh

In Bangladesh the shipbreaking industry was born out of a severe cyclone in 1960, which killed thousands of people and a Greek ship "M D Alpine" was driven ashore by the devastating tidal storm and could not be refloated and was confined to Fauzdarhat sea shore of Sitakunda Upazilla (Fig.3). The ship remained there for a long time. In 1964 Chittagong Steel House bought the vessel and scrapped it. It took years to scrap the vessel, but the work gave birth to the industry in Bangladesh.

During the liberation War in 1971, a Pakistani ship "Al Abbas" was damaged by bombing. Later on this was salvaged by a Soviet salvation team from Chittagong port and bought to the Fauzdarhat seashore. In 1974 the Karnafully Metal Works Ltd bought this as scrap, which is considered as introduction of commercial ship breaking in Bangladesh.

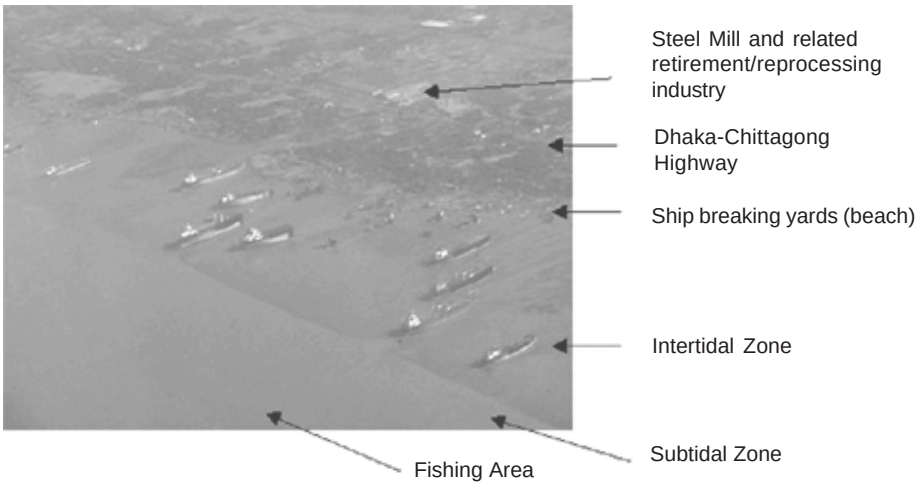


Fig. 3 Overview of the ship scrapping area of Chittagong (DNV, 2001)

Following these tentative beginnings, the shipbreaking sector experienced a boom in the 1980s. As developed countries like United Kingdom, Spain, Scandinavian countries, Brazil, Taiwan, and South Korea wanted to get rid of an industry, which was not in compliance with the new environmental protection standards, Bangladeshi industrialists took the opportunities allured by huge profit. Businessmen involved in the industry imported more and more ships and Bangladesh bit by bit began to play a major role. As a result, within a short period Bangladesh established monopoly in the international market of big ship scrapping. Statistics (DNV, 1999) shows that about 52% of big ships are dismantled in Bangladesh (Fig. 4).

Ship breakers in Bangladesh, think 1980s as the golden age. At that time, although there was already a substantial body of legislation, particularly in respect of industry, the owners of the shipbreaking yards took advantage of the laisser-faire climate (FIDH, 2002)

The nature of this site also offered many advantages making it particularly suitable for ship breaking:

- A long, flat uniform intertidal zone,
- An extended beach with tidal difference of 6 meters,

- Protection by the Bay of Bengal,
- Stable weather conditions,
- Low labour costs,
- Some existing infrastructure (connected to the capital Dhaka by road and railway),
- Moderate enforcement of laws,
- Low level of environmental awareness,
- Huge demand of iron and steel in local market,
- Nearby location of rolling mills-essential outlet for the steel of the dismantled ships.

At present there are 24 ship breaking yards in this area and the area extend from over 14 kms along Fauzdarhat to Kumira Coast (YPSA, 2005). Every year 60-65 ships are either being dismantled or awaiting dismantling process (SHED, 2002). Once about 150 companies were engaged in ship scrapping activities (Rahman, 1994). At that time, more than sixty shipbreaking yards were tearing tankers and container ships apart, but paying no taxes or levies. Nor was there any oversight of the yards. The new industrial sector was also preyed upon by shady businessmen who bought ships for millions of taka using government (subject to corruption) loans and then disappeared with the loans. As time went on the banks began to be more careful and the government imposed tax on the industry.

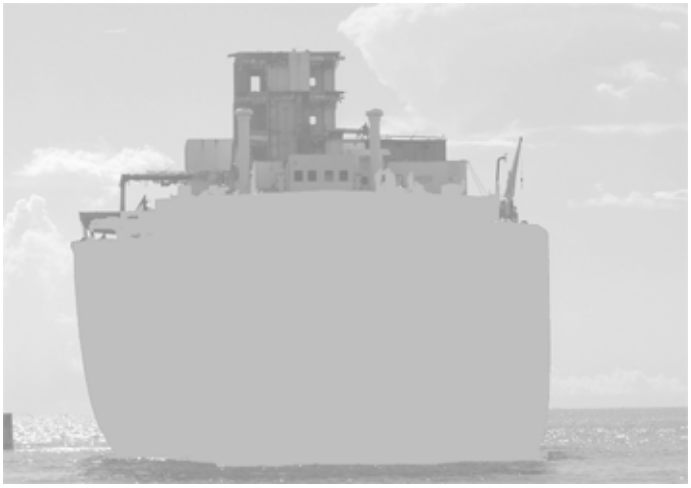


Fig. 4 About 52% of big ships of the world are dismantled in Bangladesh (Photo: Author, 2004)

The huge profits and scams of all types of the 1980s gave way to a less anarchical, more controlled activity. Within a decade or so the number of operating shipbreaking yards was reduced by two-thirds. Despite this change, the shipbreaking yards remain a distinct industry in Bangladesh, an activity which employs more than 100,000 blue and white collar workers for which it is impossible to obtain statistics, a dirty and dangerous industry which prefers to keep its secrets to itself and businessmen who generally consider themselves to be above the law.

Generally the following three types of vessels are scrapped in the Chittagong ship breaking yards.

a. Tankers

b. Cargo ships

c. Container ships.

Bangladesh breakers prefer to demolish the above types of vessels for reasons, such as availability of lucrative items, relatively safe and easy breaking operation and secured journey of the vessels to beaching site. The main sources for purchase of unserviceable vessels are Russia, Bulgaria, Romania, Greece, Italy, Turkey, Japan, Singapore, South Korea, etc. Towing of a dead ship for scrapping is costly and time consuming, so the Bangladeshi ship breakers and their agents generally prefer to buy ships on voyage or ships anchored in Singapore or at a port near to Chittagong, i. e. located at any port of India, Sri Lanka, Myanmar and Thailand (Rahman &Tabarok Ullah, 1999; FIDH, 2002). Another reason for preference of ships on their last voyage is that it can easily bypass the laws of pollution- free certification.

4. Steps involved in ship breaking

The ship breaking process starts a long way from the Bangladesh coast. The owners of the Bangladeshi shipbreaking yards are kept abreast of the ships to be sold for scrap by brokers operating from London, Dubai, Singapore and Hamburg. All ships are sold by the ton, at a price ranging from 110 to 150 dollars per ton depending on the market price. As soon as the ship is purchased the clock starts to tick for the owner, who must have it dismantled as fast as possible to recover his investment. So, once bought in Singapore they sail posthaste on their last crossing to the demolition yards of Chittagong-generally a two weeks journey (FIDH, 2002).

Once the ship arrives in the Bay of Bengal, the ship is anchored in international waters off Chittagong and the first administrative steps are set in motion .As per rule, the ship is inspected, checked and made gas free. Finally, once all the administrative formalities have been completed, the Chittagong Port Authority issues a permit for the ship to enter territorial waters for beaching. The ship's captain puts the ship in position off the coast and waits for the ideal time to perform the beaching maneuver. Vessels are beached by own propulsion power at high tide and during low tide vessels are lying stable on their flat bottom.

The ship must be placed in this exact position and above all come to ground as high up on the beach as possible to facilitate dismantling operations. Beaching has a crucial impact on the final cost; the time needed for dismantling can be doubled, if the beaching operation is not successful.

During the second phase, cutters and their helpers start cutting the vessel into parts. The breaking operation is undertaken based on the structural design of the vessel. The larger parts are dragged to the dry part of the shore with the help of motorized pulley. A large number of workers are also engaged in this operation. Though the motor does the main job, workers need to help the pulley driver in dragging the part to the dry area of the shore.

Another group of cutters, helpers and workers start cutting the dragged parts of the ship into truckable parts as per order of the purchasers. Heavy equipment like boilers, motors, capstan stocking etc. are carried to stack yards by moving crane. The unskilled workers carry metal plates, metal bars or pipes on their heads or shoulders, start walking in synchronized steps with the rhythm of the singers call up to a definite destination and then pile up metal plates in stack yards or load them on trucks (Fig.5). The supervisors control the group of workers; the on-looker guides them and helps them in pilling up the heavy metal plates in stacks.

Fig. 5. Loading of metal plate on truck (Photo: Author, 2004)

The ship is cut down into different pieces and winched to the shore at high tide and further large portion is cut into suitable pieces on the beach for easier loading and transportations. The valuable components (e.g. small motors and pumps, generator, navigation equipments, life saving equipments, furniture, electrical cables, utensils etc.) are dismantled and sold to second hand market situated on both sides of the Dhaka-Chittagong highway. It needs 5-6 months to dismantle a typical cargo ship (Fig. 6).

Fig.6 A typical cargo ship needs 5-6 months to dismantle (Photo: Author, 2004).

5. Role of ship breaking activities in our national economy

Ship breaking activities hold potential as it creates economic opportunities for thousands of labourers and contribute to the economic growth of regions in need of private sector investment. Practically 100% of the ship is recycled. In this perspective, ship breaking can be claimed to be a sound sustainable industrial activity. In the terms of an OECD (2001) report on ship scrapping: "Ship demolitions remove large volumes of obsolete tonnage from fleets, recycle many of the materials used in a ship's construction and is a major employer in the main ship-breaking areas". Bangladesh is no exception.

The ship breaking activities play an important role in the national economy. Some of which are mentioned below:

i. Saving lots of foreign currency: It is the second largest industry in Chittagong after the commercial activity in the port. Ship breaking activities is of great importance in national economy as it saves a lot of foreign exchange by reducing the import of steel materials.
ii. Raw materials for industry: Bangladesh does not have iron, as such, has to depend on the scrapped iron to feed the re-rolling mills and steel factories. Ship scrapping is an important source of raw materials as it feeds the steel mills, steel plate re-manufacturing, asbestos re-manufacturing, lubricating, oil regeneration and other industries.
iii. Source of Government revenue: Government earns annual revenue of about Tk.700 crore from ship breaking each year through import duties (7.5%), yards tax (2.5%) etc (YPSA, 2005).
iv. Employment opportunities: Ship breaking activities offer direct employment opportunities for about 25,000 people. Moreover about 200,000 are also engaged in different business related to ship breaking activities (YPSA, 2005).
v. Sources of building materials: Bangladesh needs 8 million tons of building materials per year of which the most needed material is iron and ship breaking activities is supplying 90% iron materials of the country (Ronning, 2000).
vi. Second hand trade materials: Along the road from Chittagong to Dhaka, several shops are located offering almost anything to be found on board of a vessel (Fig. 7). Examples are:

- Small motors, pumps and machines (e.g. lathe),
- Navigation equipment (e.g. sextants). - Life saving equipment (e.g. life buoys, lifeboats, life west), flags and navigational manual,
- Personal protective equipment (e.g. helmet, boots, gloves, overalls),
- Chemicals and paint,
- Different steel parts (e.g. anchor, chains, ventilation parts, pipes),
- Toilet and sanitary equipment (e.g. toilets, sink, and bathtubs),
- Furniture (e.g. sofa, chairs, tables, beds),
- Cables and electrical wiring (undamaged cables are reused while damaged cables are burned),
- Batteries - Insulation material (e.g. asbestos and mineral wool),
- Kitchen equipments, dishes, canned goods and foods store of all sorts,
- Insulation materials (e.g. asbestos and mineral wool), and Televisions, fans etc.

vii. Others: Nothing goes to waste. The insignificant object, the smallest part of a ship is also recycled or resold. As such, even the last drops of oil from the tanker's holds are drained and resold.

Fig. 7 A view of furniture shop based on ship breaking activities (Photo: YPSA, 2005)

More over,

- The garments manufacturing factories use engines and generators of the abandoned ships.
- Boilers are mainly used in the rice mills, garments washing plants, knitting plants and other industries.
- There is great demand for the wooden planks and furniture, which are sold on the markets in the Dhaka-Chittagong high way (DNV, 2001).

6. Hazards involved in ship breaking activities

Ship breaking activities are being condemned as the whole process entails a series of risky tasks and as a depot of hazardous substances, which pose threats to the ambient environment and working people. Depending on their size and function, scrapped ships have an unladed weight of between 5,000 and 40,000 tones (an average of 13000+), 95% of which is steel, coated with between 10 and 100 tones of paint containing lead, cadmium, organotins, arsenic, zinc and chromium. Ships also contain a wide range of other hazardous wastes, sealants containing PCBs; up to 7.5 tones of various types of asbestos; several thousands liters of oil (engine oil, bilge oil, hydraulic and lubricant oils and grease). Tankers additionally hold up to 1,000 cubic meters of residual oil. Most of these materials are defined as hazardous waste under the Basel Convention. In Asia old Ships containing these materials are being cut up by hand, on open beaches, under inhumane working conditions.

Experts at home and abroad are unanimous in their opinion that ship breaking is a high-risk industry. “By any standards, the demolition of ships is a dirty and dangerous occupation”, writes Paul Bailey in his ILO discussion paper -7. The hazards linked to shipbreaking broadly fall into two categories: intoxication by dangerous substances, and accidents on the plots. A brief description on the common hazards that may cause work related injuries and death among ship breakers; waste components in the vessel or board and waste and toxic substances that may inherent in the vessel structure can be seen in table 1, 2 and 3 respectively.

Most of the accidents are caused by toxic gas explosions. Another main cause of accidents is the fall of heavy metal plates from upper decks (which are up to 70 m high) to lower one who work there with no safety harness. Other accidents include workers being crushed by falling steel beams and plates and electric shocks (FIDH, 2002)

As a matter of fact, it is simply a too risky job for such a little pay. The entire scrapping process remains manual. Worker’s safety is jeopardized by a near-total absence of precautions and planning. Limited amount of electricity is used for ship breaking activities. Testing system of cranes, lifting machinery and motorized pulley is almost not done. The yards re-use ropes and chains recovered from the broken ships without testing and examining their strength and carrying capacity. There is no marking system of loading capacity of the chains of cranes and other lifting machineries. The untrained workers carry truckable pieces of iron sheets on their bare shoulders that can be more conveniently done by lorries. They do not know the weight of the sheets and chunks they carry and the employers also close their eyes about of the legal limit of weights carried by workers (Fig. 8). Usually, these workers carry weights far above the limit prescribed in the Factories Act and Factories Rules.

There is no training for workers about the dismantling process and no safety measures. So, workers are not aware of hazards to which they are exposed. Therefore, workers suffer from suffocative injury and lung problems, which cause temporary loss of working capacity. Ships are not properly cleaned before beaching. Generally, an eyewash test is carried out to certify that a ship is free from dangerous chemical and fumes. As a result the hatches and pockets of vessel often contain explosive or inflammable gases and during cutting operation of the ships, fire breaks out accompanied by explosions (Fig. 9).

Fig. 8 Unskilled workers carry truckable pieces of iron sheets on their shoulders (Photo: Author, 2004)

Fig. 9 The hatches and pockets of vessel may contain explosive or inflammable gases (Photo: Reichmann, 2005)

Though shipbreaking is a risky occupation and entails life risk due to accident and fatal occupational diseases, but the employers do not provide any PPE (personal protective equipment) in general and appropriate PPE in specialized areas. Labourers are not provided with safety facilities and working equipment such as helmets or gumboots. There is no equipment for machine safety, chemical safety and water safety. Gas cutters and their helpers are cutting the steel plates almost round the clock without protection of eyes, so their eyes are always vulnerable to welding effects. They do not wear any uniform and never use any coverall or hand gloves, goggles,

boots and work suit. These types of crude attempts very often cause severe explosions. It is found that the beaches, where ship breaking takes place are strewn with chemicals and toxic substances, small pieces of pointed and sharp iron splinters pasted on the surface of the beach causing injuries. Workers enter into such areas without taking any precautionary measure and work bare footed. Occupational health and safety is not important to the employers, they hardly rarely maintain a First-aid Box.

Most of the workers are illiterate, very poor and are not conscious about their health, safety and the dangerous effects of the poisonous chemicals. Accidents are not reported or recorded. If any worker is affected by occupational diseases, he is no more employed by any of the employers. The employers through adoption of various unfair practices usually conceal information when any worker dies due to occupational accidents. In most cases, families of the victims are not informed, as contractors do not use proper names and addresses of the workers and there is no monitoring or inspection by the Inspection and Labour Department of the concerned ministry (Rahman and Tabarok Ullah, 1999).

On average one ship breaking worker dies at the yards in Bangladesh every week and every day one worker gets injured. These casualty numbers of poor toiling masses can never be found in any official statistics. It seems that nobody really bothers about the tears of ship breaking workers, they are treated as replaceable instruments for the yard owners. One is lost, so get another to replace him.

Table.1. Common hazards that are likely to cause work-related injuries and death, ill health, diseases and incidents among ship breaking workers (ILO, 2003).

Serious Accident Hazards	
ı Fire and explosion: explosives, flammable materials	ı Falls from height inside ship structures or on the ground
ı Being struck by falling objects	ı Struck by moving objects
ı Compressed between heavy objects	ı Slipping on wet surfaces
ı Snapping of cables, ropes, chains, slings	ı Sharp objects
ı Handling heavy objects; poor access to progressively dismantled vessels (floors, stairs, passage ways)	ı Oxygen deficiency in confined spaces. Lack of PPE, housekeeping practices, safety signs
Hazardous Substances	
ı Asbestos fibres,dusts	ı PCBs & PVC (combustion products)
ı Heavy and toxic metals(lead, mercury, cadmium, copper, zinc etc.	ı Welding fumes
ı Organometallic substances (tributylin, etc.)	ı Volatile organic compounds (solvents)
ı Lack of hazard communication (storage, labeling, material safety data sheets)	ı Inhalation in confined and enclosed spaces
ı Batteries, fire-fighting liquids	ı Compressed gas cylinders
Physical Hazards	
ı Noise	ı Vibration
ı Extreme temperatures	ı Poor illumination

Mechanical Hazards	
ı Trucks and transport vehicles	ı Shackles, hooks; chains
ı Scaffolding, fixed and portable ladders	ı Cranes, winches, hoisting & hauling equipment;
ı Impact by heavy and sharp-edged tools	ı Lack of safety guards in machines
ı Power-driven hand tools, saws, grinders abrasive cutting wheels	ı Poor maintenance of machinery and equipment
Biological Hazards	
ı Toxic marine organisms	ı Animal bites
ı Risk of communicable diseases transmitted by pests, vermin, rodents, insects and other animals that may infest the ship	ı Infectious diseases (TB, malaria, dengue fever, hepatitis, respiratory infections, others)
Ergonomic and Psychological Hazards	
ı Repetitive strain injuries, awkward postures, repetitive and monotonous work, excessive workload.	ı Mental stress, strained human relations (aggressive behavior, alcohol and drug abuse, violence)
ı Long working hours, shift work, night work, temporary employment	ı Poverty, low wages, under age, lack of education and social environment
General Concerns	
ı Lack of safety and health training	ı Inadequate accident prevention and inspection procedures
ı Poor work organization	ı Inadequate emergency, first-aid and rescue facilities
ı Inadequate housing and sanitation	ı Lack of medical facilities and social protection

Table 2. Wastes and substances that may be inherent in the vessel's structure

Wastes	Waste-location on the ship
Antimony	Alloys with lead in lead-acid storage batteries, solder
Beryllium	Hardening agent in alloys, fuel containers, navigational systems
Cadmium	Bearings
Lead	Connectors, couplings, bearings
Tellurium	In alloys
Antimony compounds	Fire retardation in plastics, textiles, rubber etc.
Cadmium compounds	Batteries, anodes, bolts and nuts
Lead compounds	Batteries, lead and chromate paint, paint coatings, cable insulation, lead ballast, generators, and motor components
Arsenic: arsenic compounds	Paints on the ship's structure

Mercury: mercury compounds	Thermometer, light fittings, electrical level switches, mercury in fluorescent light tubes, fire detectors, and tank-level indicators
Hexavalent chromium compounds	Paints (lead chromate) on the ship's structure
Waste zinc residues	Anodes (Cu, Cd, Pb, Zn)
Waste lead-acid batteries, whole or crushed	Batteries: emergency, radio, fire alarm, start up, lifeboats
Glass waste from cathode-ray tubes and other activated glasses	TV and Computer screens
Asbestos	Thermal insulation, surfacing material, sound insulation, hanger liners, mastic under insulation, cloth over insulation, cable, lagging and insulation on pipes and hull, adhesive, gaskets on piping connections, and valve packing
Mineral oils unfit for their originally intended use	Hydraulic fluids, oil sump (engine, lubricant oil, gear, separator etc.) oil tank residuals (cargo residues)
Non-halogenated organic solvent	Antifreeze fluids
Polychlorinated biphenyl (PCBs), Polychlorinated terphenyl (PCT), Polychlorinated naphthalene (PCN) or Polybrominated biphenyl (PBB) or other polybrominated analogues of these compounds	Capacitors in light fittings, PCB in oil residu als, gaskets, couplings, wiring (plastics in the ship's structure) cable insulation, transformers, capacitors and electronic equipment with transformers and Capacitors inside, oil-based paint, anchor windlasses, equipment for cargo handling (such as crane and pump arrangements), sealing materials and glues used in windows, electrical components in powering systems and in electric lighting including fittings and heat exposed electrical components (condensators). Also in rubber products such as hoses, plas tic foam insulation, cables, silver paint, hab itability paint, felt under septum plates, plates on top of the hull bottom, and primary paint on hull steel
Waste of explosive nature	Compressed gases (acetylene, propane, butane), cargo residues (cargo tanks)

Table 3. Waste components that may be on board of the vessel

Wastes	Products where waste may be found
Unsorted waste batteries	Portable radios, torches
Waste non-halogenated organic solvents	Solvents and thinners
Waste halogenated organic solvents	Solvents and thinners
Wastes from the use of pharmaceutical products	Miscellaneous medicines
Wastes from the use of biocides and phytopharmaceuticals, including waste pesticides and herbicides which are off-specification, outdated, or unfit for their originally intended use	Insecticide sprays
Wastes from the production, formulation and use of links, dyes, pigments, paints, lacquers, varnish	Paints and coatings
Waste consisting of or containing off specification or outdated chemicals	Consumables
CFC (R12-dichlorodifluoromethane, or R22-chlorodifluoromethane)	Refrigeration devices such as water coolers and small freezer units, styrofoam
Halons	Fire fighting equipment
Radioactive material	Liquid-level indicators, smoke detector, emergency signs
Micro organisms/ sediments	Ballast water systems
Fuel oil, disel oil, gas oil	Ballast water systems (including tanks)

(Source: UNEP, 2002; ILO, 2003; OSHA, 2001)

7. Pollutants discharged from ship breaking and their impacts

Oceangoing vessel is a mini version of a city and during scrapping discharges every kind of pollutants a metropolis can generate like liquid, metal, gaseous and solid pollutants. So ship-breaking activities became perilous in respect of environment, human health and biodiversity. Of which human health concerns are of following pollutants.

7.1. Persistent Organic Pollutants (POP's)

POPs are chemicals that are highly toxic, remain intact in the environment for long periods, become widely distributed geographically, bioaccumulate through the food web, accumulate in the fatty tissue of living organisms and pose a risk of causing adverse effects to human population, wildlife and the environment. There has been a realization that these pollutants, upon exposure of human population, can cause serious health effects ranging from increased incidence of cancers to disruption of hormonal system. These effects have also been observed and recorded for various animal species. Developing countries are particularly vulnerable due to often-indiscriminate use and disposal of POPs. Ship breaking activities is a potential source of lethal Persistent Organic Pollutants (POP's). Exposure to POPs may cause acute, medium or long-term impacts.

a. Acute poisoning

The early manifestations of acute poisoning (usually due to exposure to large quantities in a very short time) include an increase in sensitivity and a tingling sensation in the face and limbs, although giddiness, lack of coordination, tremor, and mental confusion may also occur. In the case of ingestion, gastrointestinal irritation (vomiting and diarrhea) is presented. In the most severe cases of intoxication, there are muscular contractions, followed by generalized convulsions High concentrations of these substances increase cardiac irritability and may produce cardiac arrhythmia. Coma and respiratory depression may also occur.

b. Medium-and long-term effects

These effects can be observed after a single exposure to a large non-lethal dose or after repeated exposures to doses that are usually low. The reproductive impact of POPs includes abortion, retardation of fetal growth, birth defects (teratogenesis), and an increase in mortality among the newborn of exposed mothers. Infertility and loss of libido have been reported in humans exposed to aldrin and dieldrin. Except, for mirex and toxaphene, all POPs are mutagenic. All these pesticides are considered potential carcinogens of greater or lesser strength. Chlordane, DDT, heptachlor, aldrin and dieldrin are associated with liver cancer. DDT is also associated with breast cancer and dieldrin with cancer of the adrenal glands.

c. Other effects

Other effects that are observed after medium or long term exposure to POPs may include, loss of appetite, weight loss, nausea, headaches, sleep alterations, signs that numerous peripheral nerves are affected, liver and renal damage, generation of liver enzymes (which can accelerate the metabolism of drugs and other products), cardiac arrhythmia, eye damage such as allergic conjunctivitis, blepharitis, and retinal angiopathy. Changes in personality and difficulties in concentrating have been noted in people exposed to heptachlor.

Scrapped ships are infested with the following POPs in particular:

i. Polychlorinated Biphenyl Compounds (PCBs)

PCBs are found in solid and liquid forms. There is inadequate study or report on PCB contamination from Bangladesh except a study on marine shrimp and fin fish from Bangladesh by Hossain (1989). The study by Hossain (1989) on PCB contamination by Σ (28-180) in commercially important marine samples (3 shrimp & 3 finfish species) collected from Bangladesh ranges between ND-80 ng/g wet wt. Relatively higher values were observed in shrimp *P. indicus* (30 ng/g wet wt.) and in finfish *T. ilisha* (80 ng/g wet wt.). Higher concentrations were recorded from shrimps & finfishes in the North Sea and the Mediterranean but values similar to Hossain (1989) ware found in subtropical Malaysian species (Tanabe,1988). Another analysis of soil from a steel plate re-processing site of Chittagong ship breaking yards on Σ PCBs (7 toxic congener's Σ (PCB_{28} –PCB_{180}) found the amount varied from 1.444-0.2 mg/kg in dw (DNV, 2001).

However, over the last 10-15 years in Bangladesh, as in other developing countries, the usage of capacitors, transformers & other PCB's containing products from dismantling of old ships and other sources has increased many folds; and there is no legislation to control or manage the old stocks of PCB containing products in Bangladesh. That is the real danger or risk for PCB contamination in marine Biodiversity (higher trophic level) and human health for Bangladesh and certainly the contamination of PCBs will be more in the year's ahead (Hossain, 2002).

Impacts: PCBs are highly toxic and persistent pollutants. They bioaccumulate and get highly magnified in the fatty tissue, especially in higher trophic level of the food chain. Exposure to PCBs has been associated with a variety of adverse health problems. PCBs have been linked to cancer, liver damage, reproductive impairments, immune system damage and behavioral and neurological damage (Tanabe, 1988; Hossain, 1989; Hossain, 2004).

ii. Dioxins

Dioxins known human carcinogen, is produced when chlorine products like PCBs (Polychlorinated Biphenyls) and PVCs are made or burned (Fig. 10). Dioxins are the most toxic substances man has ever released into the environments. Burned in open fires on the ship breaking yards, dioxins are constantly inhaled by the workers. In most western countries the emissions of dioxins are strongly regulated. A UN-treaty on POP's (2001) banned dioxins worldwide.

Fig. 10 Dioxins arise when chlorines products are burned (Photo: Author, 2004)

Impacts: Dioxins are carcinogenic and can suppress the immune system. Dioxins are suspected of prenatal and post natal affects on children's nervous system. Among other things, dioxin has been linked to endocrine disruption, reproductive abnormalities, neurological problems, and infertility in humans and animals. In addition, large amounts of chemicals called "phthalates" are used to manufacture PVC products. A commonly used phthalate plasticizer called diethylhexyl-phthalate (DEHP) is probably reproductive toxicant, as well as a toxicant of the liver and kidney.

Moreover dioxin exposures to humans are associated with increased risk of severe skin lesions such as chloracne and hyper-pigmentation, altered liver function and lipid metabolism, general weakness associated with drastic weight loss, changes in activities of various liver enzymes, depression of the immune system (Mukerjee, 1998).

iii. Polyvinyl Chloride (PVC)

Lots of equipment and materials in ships are made of PVC. PVC poses serious threats to environmental health at every stage of its existence (production, use and disposal). At the end of its life, PVC waste creates intractable disposal problems because it is expensive and unsafe to burn. It releases hazardous chemicals into groundwater and air when buried, and is not so easily or cheaply recycled.

Degraded PVC releases volatile organic chemicals such as 3-ethyl-1-hexanol and 1-butanol, into air that causes asthma. Among the dangers when PVC burns in open fires are dioxin generation, the formation of hydrochloric acid mist, and the generation of thick, choking smoke.

Impacts: Polyvinyl chloride (PVC) can have a negative impact on the environment and human health. PVC has been known to cause Raynaud's syndrome, scleroderma, cholangiocarcinoma, asthma angiosarcoma, liver cancer, brain cancer, acroosteolysis and risks of impaired human reproduction etc(Steingraber,2004).

iv. Polycyclic Aromatic Hydrocarbons (PAHs)

PAHs are released during torch cutting and afterwards when paints continue to smolder or when wastes are deliberately burned. About 250 PAHs are known. Some harmful PAHs are Naphthalene, Phenanthrene, Anthracene, Fluoranthene, Pyrene, Benzo(a)anthracene, Chrysene Benzo(k)fluoranthene, Benzo(a)pyrene, Benzo(ghi)perylene, Indenopyrene. The health hazards from PAHs comes from directly inhaling fumes, during torch cutting, smoldering of paints and burning of wastes. PAHs accumulate in dust and sediment, and tissues of life forms (Fig. 11). As a result they are available for uptake either through inhalation, dermal contact or via the food chain.

Impacts: Some PAHs have been shown to cause cancer in laboratory animals, and also in humans following occupational exposure at high concentrations. Some 30 compounds and several hundreds of derivatives are carcinogenic. A number of PAHs have been shown to be genotoxic (i.e. they interact with the genetic material in cells). The EU Scientific Committee on Food (SCF) identified 15 PAHs that may be genotoxic and carcinogenic to humans (SCF, 2002). PAHs cause malignant tumors by interfering with enzymatic breakdown, affecting the lungs, stomach, intestine and skin.

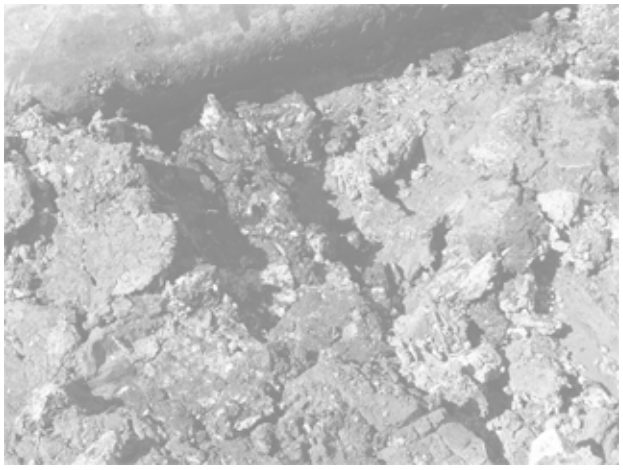


Fig. 11 Black oil residues (PAHs) accumulate in soil of the ship breaking area, Chittagong (Photo: Author, 2004)

v. Organotins

Organotins are nerve toxins that accumulate in the blood, liver, kidneys and brain. Some notorious organotins are Tributyltin (TBT), Triphenyltin, Dibutyltin, Dicyclohexyltin, Diphenyltin Tricyclohexyltin. Analysis of soil from a steel plate re-processing in Chittagong ship breaking area found Monobutyltin (MBT) ranges from 1.9 to 0.72 mg/kg, Dibutyltin(DBT) ranges from 2.4 to 1.38 mg/kg and Tri-butyltin(TBT) ranges from 25 to 17 mg/kg, all in dry weight (DNV,1999).Tributyltin (TBT) is an aggressive biocide (kills living organisms) that has been used in anti-fouling paints since the 1970s. Concerns over toxicity of these compounds (some reports describe biological effects to marine life at a concentration of 1 nanogram per liter) have led to a world-wide ban by the IMO in 2003.

Impacts: TBT is considered as one of the most toxic compounds in the aquatic ecosystems; its impact on marine organisms range from the subtle to the lethal. TBT is responsible for the disruption of the endocrine system of marine shellfish leading to the development of male characteristics in female marine snails. TBT also impairs the immune system of organisms. Shellfish are reported to have developed shell malformation after exposure to extremely low levels of TBT in the seawater. High doses of organotins have been shown to damage the central nervous system and reproductive mechanisms in mammals. The most widely used organotins, tributyltin (TBT), is an endocrine disrupting chemical in mammals. There is evidence of organotins having an endocrine disrupting effect in fish. Some recent works appear to suggest that the consumption of contaminated fish is posing a real threat to humans. Organotins also bioaccumulate in certain marine species, some of which are food species used by humans.

Organotins have endocrine disrupting ability in humans. Butyltins disrupt the critical function of human immune cells, particularly killer cells. As organotin compounds can damage human health even in small doses, in industrialised nations, legal regulations are in place to protect workers from exposure to antifouling paints containing TBT. Skin, eye and lung protection are mandatory for any contact work with TBT-containing paints (Adams, 1999, DNV, 1999, Greenpeace, 1999 and 2001, ILO, 2003 and US-EPA , 2000).

7.2. Asbestos

Asbestos is the name given to a group of six different fibrous minerals (amosite, chrysotile, crocidolite, and the fibrous varieties of tremolite, actinolite, and anthophyllite) that occurs naturally in the environment. All forms of asbestos are hazardous, and all can cause cancer, but amphibole forms of asbestos (have straight, needle-like fibres) are considered to be somewhat more hazardous to health than chrysotile. On the ship breaking beaches of Asia, asbestos fibres and flocks fly around in the open air. Men take out asbestos insulation materials with their bare hands (Fig. 12&13). They dry it in the sun, so they can sell it (DNV, 2001).

Asbestos fibers do not have any detectable odor or taste. They do not dissolve in water or evaporate and are resistant to heat, fire, chemical and biological degradation.

Fig. 12 Workers take out asbestos and glass wool from engine room of scrapped ship without having any protective tools (Photo: Author,2004)

Impacts: Workers who repeatedly breathe in asbestos fibers with lengths greater than or equal to 5 µm may develop a slow buildup of scar-like tissue in the lungs and in the membrane that surrounds the lungs. This scar-like tissue does not expand and contract like normal lung tissue and so breathing becomes difficult and hampers its ability to exchange gases. Blood flow to the lung may also be decreased, and this causes the heart to enlarge. This disease is called asbestosis. People with asbestosis have shortness of breath, often accompanied by a cough. This is a serious disease and can eventually lead to disability or death in people exposed to high amounts of asbestos over a long period.

Asbestos workers have increased chances of getting two principal types of cancer: cancer of the lung tissue itself and mesothelioma, a cancer of the thin membrane that surrounds the lung and other internal organs. It is considered to be exclusively related to asbestos exposure. By the time it is diagnosed, it is almost always fatal. Similar to other asbestos related diseases, mesothelioma has a longer latency period of 30 to 40 years.

Changes in the membrane surrounding the lung, called pleural plaques, are quite common in people occupationally exposed to asbestos and are sometimes found in people living in areas

with high environmental levels of asbestos. There is also some evidence from studies of workers that breathing asbestos can increase the chances of getting cancer in other locations (for example, the stomach, intestines, esophagus, pancreas, and kidneys).

Fig. 13 Woman filters asbestos into powder in workshop outside the shipbreaking yards, Bangladesh (FIDH, 2005).

Members of the public who are exposed to lower levels of asbestos may also have increased chances of getting cancer, but the risks are usually small and are difficult to measure directly (ATSDR,1998) It should be noted that there is a synergistic effect between smoking and asbestos exposure, which creates an extreme susceptibility to lung cancer.

7.3. Heavy metals

Heavy metals are found in many parts of ships. Such as in paints, coatings, anodes and electrical equipment (Fig. 14). The following heavy metals are part of old ships scrapped by workers without the correct protective equipment. These parts are often dumped or burnt on the beaches causing widespread pollution of the area. Heavy metal concentration in the soil sample taken by DNV(2001) from the ship breaking area of Chittagong except for Iron(Fe) were all found to be far above the background level. Especially for Copper(Cu), Lead(Pb) and Zinc(Zn), the values are high. The high concentrations were all found to be reflect heavy metals typically found in paints.

i. Mercury

Mercury, a highly toxic heavy metal exists in various forms including metallic mercury, inorganic and organic mercury compounds. Research studies show that contamination brought about by natural and man-made activities is clearly a growing problem today. The level of mercury found in the soil of ship breaking area of Chittagong ranges from 0.8 mg/ kg to 3.0 mg/kg, where the background value is only 0.1 mg/kg in dw (DNV,2001).

Impacts: This toxic heavy metal affects the nervous system. In 1956, the first recognized mercury poisoning outbreaks occurred, called “Minamata disease”. This is a disorder of the central nervous system caused by the consumption of fish and shellfish contaminated with methyl mer-

cury. Clinical manifestation differs from inorganic mercury poisoning in which the kidneys and the renal system are damaged. Young children are most vulnerable. Long term exposure to low levels can cause irreversible learning difficulties. Mercury can also cause mental retardation and delayed neurological and physical development (Greenpeace, 2005, Rivera *et.al.* 2003, Hossain, 1994).

Fig. 14 Heavy metals found in paints, coatings, anodes and electrical equipments etc. (Greenpeace, 2005)

ii. Lead

Pb a toxic heavy metal that accumulates in blood and bones after inhalation or ingestion. Lead may enter the human system mainly through inhalation but also through ingestion. Most of the lead that enters the human body accumulates in the bones. The concentration of lead in the soil found in the ship breaking area of Chittagong ranges from 4,232 mg/kg to 5,733 mg/kg where the background value is 144 mg/kg, all in dw (DNV, 2001).

Impacts: The effects of lead upon human health have been known for a long time. Long term exposure (greater than 14 days) to lead may cause brain and kidney damage, increased blood pressure. Young children are most vulnerable to its toxic effects. Studies on the effects of lead in children have demonstrated a relationship between exposure to lead and a variety of adverse health effects. These effects include impaired mental and physical development, decreased heme-biosynthesis, elevated hearing threshold, and decreased IQ and serum levels of vitamin-D. Long-term exposure to even low levels can cause irreversible learning difficulties, mental retardation and delayed neurological and physical development, even death (Green peace, 2005; ATSDR,1998).

iii. Arsenic

The environmental problems associated with arsenic due to its toxicity are well known. Presently, arsenic is treated as a human carcinogen and environmental agencies are pressing for stricter consumption standards. Acute exposure to inorganic arsenic has serious adverse health effects. Studies of acute toxicity show that inorganic compounds are more potent than organic ones.

Impacts: Exposure can result in lung cancer, cancer of the skin, intestine, kidney, liver or bladder. It can also cause damage to blood vessels. Inflammation of nervous tissue caused by arsenic may result in paralysis. After exposure disfiguring growth may appear on the skin, (Greenpeace, 2005).

iv. Chromium

The level of chromium found in the soil of ship breaking area ranges from 507 mg/kg to 568 mg/kg, where the background value is 144 mg/kg, all in dw.

Impacts: A small amount of chromium (0.0007 to 0.003 mg/kg/day) is considered as an essential nutrient for humans that helps normal metabolism of cholesterol, glucose, and fat. However, large amounts of Cr can be harmful. The hexavalent form of chromium is irritating and can cause acute adverse effects on the skin, gastrointestinal tract, liver and kidney (Carson *et. al*., 1987). Some chrome based chemicals can cause eczema. When exposed to dust and fumes people may develop respiratory diseases such as lung cancer (Greenpeace,2005).

v. Other Heavy metals

Among the other heavy metals found in the ship breaking area of Chittagong are ,Cu ranges from 573 mg/kg to 1211 mg/kg, background value 51 mg/kg , Hg ranges from 0.076 to 0.266 mg/kg background value 0.05 to 2.0; Mn ranges from 1,792 to 2,321 mg/kg, background value 1363 mg/kg; Zn ranges from 2,929 to 5,888 mg/kg, background value 144 mg/kg, all in dw(DNV,2001).

7.4. Oil pollution

Oil is a highly volatile compound composed of mainly hydrocarbon, sulfur containing compounds etc., approximately 75% of the constituents of oil are hydrocarbons. As a result of the breaking of the ship, oil residues and the other refuses are being spilled and mixed with soil and water in the beach (Fig. 15) and fate of the discharged oil in coastal water can be seen in the figure 16.

Fig. 15 Black oil residues collected from scraped ships often get mixed with the beach soil (Photo: Author ,2004)

Islam and Hossain (1986) detected between 10.800 and 9.280 mg/l oil in water samples and Khan (1994) detected 239 and 248 µg/l PHC (petroleum hydrocarbons) in sea water from the ship breaking area.

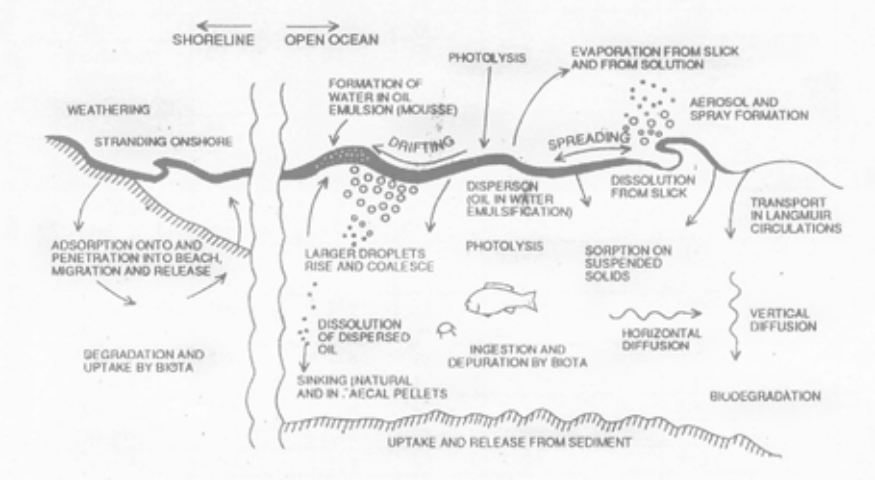


Fig. 16 Fate of Oil in the coastal environment (Mackay,1985)

i. Acute toxicity to marine organisms

Oil is a highly volatile compound composed of mainly hydrocarbon, sulfur containing compounds etc. Approximately 75% of the constituents of oil are hydrocarbons. Oil may cause serious damage in different ways. Such as impacts on:

a. Seabirds

Sea birds or diving birds spend much of their time on or near shore. They become oiled when feeding in contaminated areas such as salt-water marshes, consequently may die due to hypothermia - that is, an abnormally low body temperature, drowning or poisoning .Other effects on the feathered creature can include: damage to the liver, lungs, kidneys, intestines, and other internal organs; destruction of red blood cells important for good immune response; pneumonia; reduction in the ability to reproduce; decline in the number of eggs laid; decreased fertility of eggs and thinner shell thickness; and disruption of normal breeding and incubating behaviors.

b. Marine mammals

The consequences they may affect marine mammals due to oil pollution includes: hypothermia, resulting in metabolic shock; poisoning and toxic effects due to ingestion of oil; congested lungs and damaged airways; and gastrointestinal ulceration and hemorrhaging.

c. Fish, molluscs, crustaceans and turtles

When oil seeps into shallow or confined waters, fish can be seriously affected and may even die. Fish eggs, larvae, and juveniles are much more sensitive to damage. Eggs may not hatch or may be totally destroyed, especially when the depth of water body is not so deep. Fish absorb oil that is dissolved in water through their gills, accumulating it within the liver, stomach, and gall bladder. Although they are able to cleanse themselves of contaminants within weeks of exposure,

there may be a period when they are unfit for human consumption. Like fish, many molluscs, shrimp, and worms have a natural ability to purify themselves of contaminants, if the concentration is low or if the source has been removed.

Experts are concerned about the possible effects of oil spills on sea turtles poisoning by absorption of impurities through the skin or ingestion of contaminated food, leading to damage to the digestive tract and other internal organs; damage or irritation to airways, lungs, and eyes; and contamination of eggs, which may inhibit their development.

d. Marine plants

Kelp, marsh grass, mangroves, and sea grasses are some of the types of marine vegetation that are hurt by oil spills. Plants occupying the area between high and low tide marks also have adverse impacts.

ii.Effect on human health

In freshwater environments, perhaps the most dangerous problem is contamination of drinking water sources. Food sources, such as fish and crustaceans both marine and fresh water, may be tainted and the consumption of tainted food may causes human health problems and also loss for export trade in foreign market. Oil pollution may threaten the livelihood of fishers.

7.5. Impacts of ship breaking on physio-chemical properties of seawater and intertidal sediments

Ship scrapping activities pollute the soil and seawater environment in the coastal area of Fauzdarhat to Kumira of Chittagong, Bangladesh (Islam and Hossain 1986). During that study in 1984, concentration of ammonia toxic for marine organisms was found in beach soil and seawater with an increase in P^H . Extensive human and mechanical activities accelerate the rate and amount of seashore erosion and results in higher turbidity of seawater. Critical concentration of DO and higher BOD, Fe,TDS,TSS were found with an abundance of floatable materials (grease balls and oil films) in the seawater. The results shows deteriotion of the physiochemical properties of seawater within the ship breaking area compare to outside sampling site (Table 4a). Present situation is certainly be more aggravated and need to be thoroughly investigated to know the real status.

In ship breaking areas various refuse and disposable materials are discharged and spilled from scraped ships and often get mixed with the beach soil .The scrap from the ships is staked haphazardly on the sea shore, leaving behind an accumulation of metal fragments and rust in the soil. These together with extensive human and mechanical activities often go on as routine work for the scrapping of ships in that area as a result the beach soil loses its binding properties and this accelerate the rate and the amount of shore erosion and increase the turbidity of sea water of the area (Fig. 17).

Fig. 17 Ship breaking activities contaminate the coastal soil and sea water environment (Photo: Author, 2004)

Islam and Hossain (1986) conducted a study about the physiochemical properties of beach soil and found the following results in Fauzdarhat and Kumira sampling stations with reference to sampling station Baroaoliar Mazar outside the ship scraping yards(Table 4b).

Table 4a. Physico-chemical properties of sea water within and outside the ship breaking area (Islam and Hossain, 1986)

Physico-chemical properties of seawater	Sampling stations		
	Fauzdarhat	Kumira	Baroaoliar Mazar
Turbidity (JTU)	720	723	470
TSS (mgl^{-1})	4195	4038	2284
TDS (mgl^{-1})	1990	1982	1288
P^H	7.8	7.7	7.2
EC ($\mu s\ cm^{-1}$)	1600	1710	3036
Chloride (mgl^{-1})	470	502	789
Iron (mgl^{-1})	36.02	37.62	2.26
Ammonia (mgl^{-1})	2.67	2.92	0.26
DO (mgl^{-1})	4.10	3.90	6.36
BOD (mgl^{-1})	7.63	6.98	4.08
Oil (mgl^{-1})	10, 600	9,280	Not done

Table 4b. Physico-chemical properties of beach soil within and outside the ship breaking area (Islam and Hossain, 1986)

Physico-chemical properties of beach soil	Sampling stations		
	Fauzdarhat	Kumira	Baroaoliar Mazar
Accumulation of metal fragments (cm depth)	1.0	0.6	Not done
P^H	8.4	8.4	7.3
EC (µs cm^{-1})	324	302	508
Chloride (mgl^{-1})	113	119	23
Iron (mgl^{-1})	2.0	1.6	0.56
Ammonia (mgl^{-1})	16.1	17.22	0.87

Study on trace metal concentration is useful for the estimation of pollution trends (Froster and Wittman,1981).Siddiquee (2004) in his recent research found some trace elements including Mn, Zn, Pb, Cu.Cd and Hg higher in concentration than those of the previous findings and some trace elements including Fe, Cr, Ni were lower which have been enlisted in the table 5. The results shows large deviations of the physico-chemical properties of soils in the affected area compare to control site and standard value.

Table 5. Trace metal concentration in the sediments of affected and control sites of ship breaking activities (Siddiquee,2004)

Affected sites	Stations	Trace metal concentration								
		Fe mg/g	Mn µg/g	Cr µg/g	Ni µg/g	Zn µg/g	Pb µg/g	Cu µg/g	Cd µg/g	Hg µg/g
	Salimpur	11932.6	2.64	68.35	23.12	83.78	36.78	21.05	0.57	0.015
	Bhatiari	35216.35	8.25	86.72	35.12	102.05	122.03	39.85	0.83	0.02
	Sonaichhari	41361.71	6.89	78.36	48.96	142.85	147.83	30.67	0.94	0.117
	Kumira	20971.86	2.32	22.89	25.36	119.86	41.57	28.01	0.59	0.05
Control site	Sandwip	3393.37	1.8	19	3.98	22.22	8.82	2.05	0.19	0.02
Standard values		27000 a	1.17 b	77.2 a	56.1 a	95.0 b	22.8 b	33.0 b	0.115 a,b	0.02 a

Legend: a = IAEA (1990); b = GESAMP (1982)

7.6. Impacts of ship breaking on biodiversity

The ship breaking activities contaminate the coastal soil and sea water environment and thus impair ecological settings. The problem mainly associate with the discharge of ammonia, burned oil spillage, floatable grease balls and metal rust (iron) and various other disposable refuse materials together with high turbidity of sea water.The high P^H of seawater and soil observed may be due to the addition of ammonia, oils and lubricants. Edwards (1980) stated that 0.6-2.0 mg- ammonia/L in water is toxic to fish, since it is lipid soluble and thus can readily diffuse across the gill membrane. High turbidity of water may cause decrease the concentration of DO (Cairns, 1960) and substantially increase the BOD (Hossain,1983).Furthermore, oil spilling may cause serious damage by reduction of light intensity, inhibiting the exchange of oxygen and carbon dioxide across the air-sea water interface, and by acute toxicity. As a result the growth and abundance of marine organisms especially plankton and fishes may seriously be affected. So, indiscriminate expansion of ship breaking activities poses a potential threat to the coastal intertidal zone and its habitat (Islam and Hossain, 1986). Study on the impact of ship breaking on coastal biodiversity is scanty. However few fragmentary researches were carried out to asses the impact of ship breaking on the coastal biodiversity of Chittagong.

i. Primary productivity

Primary productivity is the base of marine food chain, which supports diverse marine life. Pollution caused by ship breaking activities severely hampers the primary productivity. Oil floating over vast area inhibits light penetration reduces photosynthesis. Reduced photosynthesis results in lower primary productivity (Islam and Hossain,1986).

ii. Phytoplankton

Phytoplankton is the primary food producers of the aquatic habitat and plays an important role in the food chain. Phytoplanktons are generally considered to be the best index of the biological productivity. Phytoplankton makes their food by photosynthesis using solar light. Phytoplankton suffers from the reduction of light intensity, beneath an oil film, which inhibits photosynthesis. Siddiquee (2004) carried out an investigation to make a comparison about the occurrence and distribution of phytoplankton in affected side and control site of ship breaking activities found the following genera in monsoon and post monsoon season; such as Anabaena, Clostratum, Coscinodiscus, Euglena and Zygnema. Abundance and occurrence in numbers as well as species richness was very poor in the ship breaking area compare to control site.

iii. Zooplankton

Drifting small floating animal, in the water body are collectively known as zooplankton on which the whole aquatic life depends directly or indirectly. They are largely governed by the interactions of a number physical, chemical and biological conditions of the ocean. As zooplankton are very sensitive to optimum condition, so the coastal pollution due to ship breaking activities may have profound effects on its survival and occurrence. Siddiquee (2004) carried out an investigation to make a comparison between the occurrence and distribution of zooplankton in affected site and control site of ship breaking area. The results showed relatively low abundance of zooplankton in the affected area .

iv. Benthos

The bottom living organisms-the benthos play an important role in the food chain (as food of fish)

especially in the intertidal zone and it is also well recognized that the richest fisheries of the world are closely related to the benthic community. The abundance and distribution of benthos is influenced by soil properties as well as on the organic matter retained in the soil. Little amount of organic matter is found in the soil sample from ship breaking area (DNV, 2001), which result in the relatively low occurrence of benthos in the intertidal zone of the ship breaking area of Chittagong (Siddiquee,2004).

v. Impacts on fish species diversity

The fishery resources of the area seems to be affected by the ship breaking activities as revealed by increased fishing efforts, reduced species diversity, increased amount of trash fish(Siddiquee,2004). Notably in comparison of past 15 years, species diversity in Set Bag Net (SBN) catch is reduced significantly. To asses the concept, a comparison was made between data on species composition of SBN by Alam *et.al.* (1989) and the data gathered from that area during the present investigation (Hossain & Islam, 2004) through random sampling along with interview with local fishermen. From the comparison, it was revealed that the following fish species were not available in the catch. To make concrete assessment about the status of threatened, endangered and extinct species of that area, it needs further research.

Table 6. The fish species not found in SBN catches of ship breaking area during present investigation(2004) in comparison to study by Alam *et.al*.(1989)

Scientific name of fish species	Local name	Scientific name of fish species	Local name
Osteogeniosus staenocephalus	Aspisoa katamach	*Sphyraena obtusata*	Khika mach
Scolopsis vosmere	Nemipscol mach	*Carangoides malabaricus*	Lohamuri mach
Eleotris fusca	Dora bailla	*Carangoides melampygus*	Bungda muri
Uranoscopus guttatus	Foton mach	*Sauridia elongata*	Tiktiki mach
Dendrophysa russelli	Kala poa	*Anodontostoma chacunda*	Koiputi mach
Bahaba chaptis	Chapti mach	*Pricanthus macracavthus*	Prica mach
Pomadasys opercularis	Grunti mach	*Pricanthus tayenus*	Prica mach
Polynemus sextarius	Kala tailla	*Cynoglossus macrolepidotus*	Lamba kukur jib
Gobuis sadanandio	Nandi bailla	*Arius thalassinus*	Kata mach
Gobuis melanosoma	Kalthu Bailla	*Apocryptes serperaster*	Dosa chau mach
Sphyraena forstegi	Khika mach	-	-

Persistent toxic metals that settle down on the sediment from various sources are a threat to the survival of all organisms and to biodiversity. Through bioaccumulation such metals enter in the food chain and bio-magnified. Concentration of some metals exceeding the tolerance limit is a threat to the fisheries, found in a more recent investigation in the fishes from ship breaking area. A study carried out in the area (Fauzdarhat-Kumira) in 1992-1993 included a quantitative investigation of trace metals in water and in edible crab *Scylla serrata* (Rahman,1994). This work concluded that the concentration of some of the metals investigated (Zn and Cu) occasionally exceeded international limits for human exposure.

vi. Impacts on other species

Indiscriminate expansion of ship breaking activities poses a threat to the coastal intertidal zone (Islam and Hossain, 1986) which is generally abundant with sea grass community, the continental shelf and the intertidal area of the ship breaking area lost the natural attributes. Coating feathers by oil which causes buoyancy and insulation losses sometimes cause damage to the marine birds (Rahman, 1994).Once flourishing mangroves and marine grasses are now replaced by oil and grease (Fig. 18).

Fig.18 Once pristine beach of ship breaking area of Chittagong now with no mangroves or grasses (Photo: FIDH, 2002)

7.7. Impacts on the coastal community and fishermen

Toxic oil and metallic substance through intake of affected fish, causes human health hazards. disruption of bio-diversity in the long run may destroy the suitability of human settlement. During the breaking/cutting period accidental death sometimes occurs. Due to lack of proper sanitation and drinking water worker's suffer from water borne diseases. As the sound pollution is a regular phenomenon during dismantling, inhabitants of the adjacent areas live in a painful situation .The poor coastal community get a variety of employment opportunities in the industry and its turn into a way of livelihood to them. On the other hand social crime, abuse of drugs and illegal activities increases with an affluent society created due to ship breaking activities in that area. Again land grabbing by the yard owners also occurs sometime. Expansion of the yard shrinks the area of the fishing villages. They have to sell their space at a very nominal price. They have rights over only 200 feet of the seashore where they dry nets and anchor boats. As the commercially important species are replaced by low priced species and scarcity of fish, many coastal fishermen are leaving their hereditary profession and moving around everyday as environmental refugees in a state of under employment and poverty to unemployment and grim poverty.

8. Socio-economic profile of ship breaking activities

8.1. Types and categories of labour

Since no machinery is used, the Bangladeshi yards use a very large number of labourers. Two major categories of labours are found in the ship breaking activities-regular and casual. Regular employees and workers are permanent categories and they have monthly wages and some other facilities. On the contrary casual workers are supplied by labour supply contractors on the basis of demands.

In the first 9 category mainly skilled workers are included like:

1. Foremen (Foremen are the leaders of the labour group; supply labour to the yard from different places and also supervise different problems of labour.Some of them work in the yard and some don't. Thus the foremen are separated from the mainstream labour.

2. Fitters (they are engaged to dismantle important parts, pipes, hardware, metal etc. of the vessel).

3. Gas cutters (the gas cutters work with gas torches. This group is divided in two sub-groups, the first working on the ship, the other on shore. These are the most skilled workers, and the best paid, but they are also (those working on board the ship) the most exposed to the risk of explosions, which are frequent.

4. Crane operators (operate cranes to load and unload)

5. Truck drivers (transport the materials)

6. Rhythmic callers/singers. (He goes on singing to synchronize steps of the group of casual workers while carrying heavy steel plates and pipes etc. from one place to another; their role is highly important).

Semi skilled and unskilled workers like: Truck helpers, Semi skilled gas cutters, Semi skilled Fitters ,Lifters, Loaders, Wire pullers, Cutter, loading and wire pulling helpers are included in casual type categories of labour.

- The group of fitters who operate on board to remove everything that can be removed before cutting commences.
- The group in charge of chains and cables moves parts of the ship, especially with winches, from the point where the ship was beached to the worksite (Fig.19).

- The group in charge of oil empties the ship of remaining fuels and hydrocarbon residues (in the case of tankers) and stores them

- The group of "sweepers" removes mud from all slices or segments of the ship after they have been dragged tens of meters inland.

- The group of loaders is in charge of the last stage of the dismantling operation: carrying steel plates and other pieces of the ship and loading them on the trucks that deliver them to buyers.

The casual type workers are mostly engaged through Labour Supply Contractors, and paid on a daily basis and work under the contractor's supervision. There are two types of security guards in Shipbreaking yards, such as those:

I. Engaged on regular basis by the enterprise;

2. Deployed by the Department of Ansar (Para-military forces), Government of Bangladesh on demand and on payment. (Rahman and Tabarok Ullah, 1999).

Fig.19 Labour of wire groups pulling wire (Photo: Reichmann, 2005)

8.2. Status of job and wages

Most of the ship breaking workers come from poverty stricken northern region of Bangladesh, where opportunity of employment is less. Usually the workers are not given an appointment letter; moreover there is no formal contract between the employee and the employer. The labour forces are always deprived from their rights and also face problems in the permanency due to lack of evidence in job. The wages of labour not only depend on working hours but also depend on types and skillness of labour. The workers are categorized according to their efficiency and wages are different accordingly.

Table 7. Working hour and salary of different types of labour. (Adopted from YPSA, 2005)

Types of labour	Working hour/day (including overtime)	Average salary (taka/day)
Cutter group	8-16	85.56-200
Plate group	8-13	82.14-104.47
Wire group	8-15	72.50-138.33
Hammer group	8	150.00
Foreman	10-14	160.00-180.00

Wages and pay of the employees of ship breaking yards as well as their working hours and overtime are not in full conformity with the law of the land. The employees, such as clerks, supervisors, foremen, master cutters are paid monthly wages ranging from Taka 3,000 to 5,000 (US$ 60-100), inclusive of house rent, medical allowance etc. Many of the skilled cutters, unskilled workers and general labourers are engaged on ‘no work no pay’ basis. They receive 70 to 80 Taka a day for every 8 hours of work. For overtime work, these workers receive extra

wages on single rate basis, while the law prescribes double the rate of the normal wages for extra hours. Similarly, workers who work on weekly holidays are not entitled to any holiday pay or any benefits in lieu. Breaks for taking meals are allowed.

8.3. Age of labourer

A survey carried out by YPSA (2005), it was found that 40.75% labour are under age group 18-22 year and only 1.13% are under age group 46-60.The most important finding is that 10.94% labour are child i.e. age < 18 (Fig.20). In addition there was some child labour involved in light works like washing cleaning and repeat collections (Ronning, 2000).

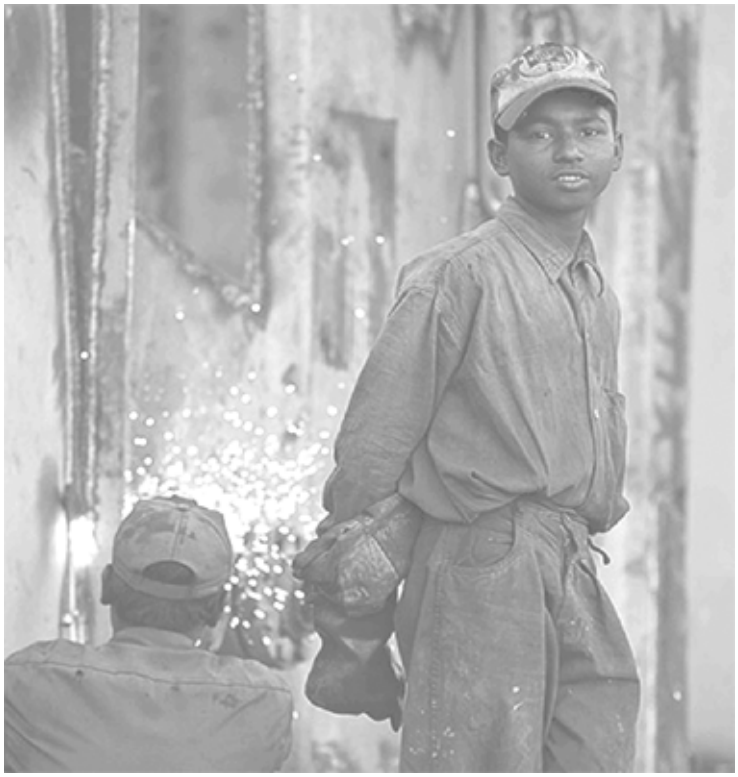


Fig .20 In the ship breaking area of Chittagong 10.94% labour are child (Photo: Reichmann, 2005)

8.4. Educational status of labourers

In the ship breaking yards a huge number of labour (46.42%) are illiterate and 43.02% labours are educated up to primary level. The huge uneducated labour force has less scope for better professional jobs within and outside the sector. Less accessibility to different opportunities including information for exercising rights, as they have almost no education and information (YPSA, 2005).

8.5. Condition of food, sanitation and work

In the ship breaking yards all the works are done manually and sometimes the workers are

forced to work more than their capacity in a short time, which causes major or minor accidents very often. There are no good arrangement for pure drinking water, healthy food, hygienic toilet and living place for labourers. A survey conducted by YPSA (2005), revealed that 86.44% labourers said they get no medical facilities from the owner, 5.93% labourers said they get all sorts of medical facilities, 4.15% labourers said they get medical facilities but in a nominal way or first aid treatment only and 1.69% labourers told sometimes they get medical facilities and sometimes not.

8.6. Health problems of labourers

Workers in the ship breaking yards suffer from many diseases and injuries that may be due to living in unhealthy and noxious as well as risky environment round the clock. According to a study carried out by Roy (2003), 88% of the workers suffered from some form of accidental injury from foot injury to larger accidents. 87% suffered from muscle pain, 72% have problems with eyesight, 52% have breathing difficulty, and gastric problems occur in 81% of labourers. Whereas, 56% of them suffered from skin diseases and 28% have other infections.

9. Ship breaking and international law

The world's oceans are not owned by any country. And ships sailing freely over them move between jurisdictions, which makes them and their owners difficult to regulate. Legislation on ship breaking is in its infancy. The rapidly evolving regulatory framework is being generated by many different international conventions and organizations. There are international obligations that nations and the shipping and the ship breaking industry have to honour. Some of these are based on explicit treaties. Some are based on customary law. A brief description of these laws and convention are presented here

9.1. The Rotterdam Convention on the Prior Informed Consent (PIC) Procedure for Certain Hazardous Chemicals and Pesticides in International Trade

A good example of customary law is Prior Informed Consent (PIC).It was adopted in 1998. Dramatic growth in chemicals production and trade during the past three decades had highlighted the potential risks posed by hazardous chemicals and pesticides. Countries lacking adequate infrastructure to monitor the import and use of such substances were particularly vulnerable. In the 1980s, UNEP and FAO developed voluntary codes of conduct and information exchange systems, culminating in the Prior Informed Consent (PIC) procedure introduced in 1989. The Convention replaces this arrangement with a mandatory PIC procedure. The Convention entered into force on 24 February, 2004. The Convention website is www.pic.int.

i. Issues relevant to ship breaking

PIC is internationally required for the trans-boundary movement of hazardous waste. The Rotterdam Convention, subjects to the Prior Informed Consent procedure for the following 30 hazardous pesticides and 11 industrial chemicals.

a. Pesticides

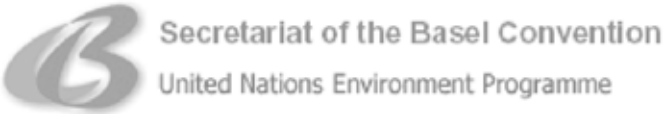
2,4,5-T, aldrin, binapacryl, captafol, chlordane, chlordimeform, chlorobenzilate, DDT, 1,2-dibromoethane (EDB), dieldrin, dinoseb, DNOC and its salts, ethylene dichloride, ethylene oxide, fluoroacetamide, HCH, heptachlor, hexachlorobenzene, lindane, mercury compounds, monocrotophos, parathion, pentachlorophenol and toxaphene, plus certain formulations of methamidophos, methyl-parathion, monocrotophos, parathion, phosphamidon and a combination of benomyl, carbofuran and thiram.

b. Industrial chemicals

Asbestos (actinolite, anthophyllite, amosite, crocidolite, tremolite), polybrominated biphenyls (PBBs), polychlorinated biphenyls (PCBs), polychlorinated terphenyls (PCTs), tris (2,3 dibromopropyl) phosphate and tetraethyl lead (TEL) and tetramethyl lead (TML).

According to this law, ship owners have to make a declaration of hazardous substances on board, on arrival at the yard for dismantling. However, PIC by itself is not sufficient to stop unsafe scrapping. What is needed is that the country from which the toxic ship arrives needs to notify the importing country. The importing country can then take measures for the adequate treatment of these hazardous substances. In several cases Greenpeace found out that end of life vessels have been exported to a ship breaking country without the importing authorities being alerted. This is particularly true in case of Bangladesh.

9.2. Basel Convention



The Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal was adopted in Basel (Switzerland) in March 1989, in response to concerns about toxic waste from industrialized countries being dumped in developing countries and countries with economies in transition. The Convention came into force on 5 May 1992. The Convention website is www.basel.int.

This global Convention works with the following aim and objectives:(i)To reduce transboundary movements of hazardous wastes and other wastes subject to the Basel Convention to a minimum consistent with their environmentally sound management, (ii) To dispose of the hazardous wastes and other wastes generated, as close as possible to their source of generation. (iii) To minimize generation of hazardous wastes in terms of quantity and hazardousness. (iv) To ensure strict control over movements of hazardous wastes across borders. (v)To prohibit shipments of hazardous wastes to countries lacking the legal, administrative and technical capacity to manage and dispose of them in an environmental sound manner. (vi) To assist developing countries and countries with economies in transition in the environmentally sound management of the hazardous and other wastes that they generate.

The Basel Convention covers hazardous wastes that are explosive, flammable, poisonous, infectious, corrosive, toxic, or ecotoxic.

i. Issues relevant to ship breaking

The Basel Convention goes further than the PIC. It imposes an obligation of 'due diligence', on all parties. All parties are required to provide information about a proposed trans-boundary movement of hazardous wastes, to the countries concerned. An exporting country must refuse the export of a ship having hazardous materials, if it suspects that the hazardous waste can not be dealt with in a sound manner in the ship breaking country. Three elements are crucial for the application of the Basel Convention to the issue of shipbreaking: 1. Proof that the waste will not be properly dealt with by the shipbreaking country 2. The legal recognition that ships are waste. 3. An established 'intention to discard' by the owner of the ship.

From various sources, it has become clear over the last few years that current practice in ship breaking states like China, Turkey, Pakistan, Bangladesh and India are not preventing pollution. In fact current practice in this market has added to pollution and accidents. This has been widely documented and recognized by governments, courts and international orgnisations such as ILO and IMO. The Basel Convention at its Open Ended Working Group has noted that a ship may become waste, in accordance with article 2 of the Basel Convention, and that at the same time it may be defined as a ship under other international rules. This is a loophole that ship owners can exploit.

The original prior informed consent procedure of the Basel Convention (Article 4.1) was strengthened by Parties' subsequent decisions to prohibit the export of hazardous wastes from OECD to non-OECD countries (Decisions II/12 and III/1). The Basel Convention imposes strict conditions on the Transboundary movement of hazardous wastes (Articles 4 and 6). Trade with non-parties is generally not permitted (Article 4.5).

9.3. The London Convention

The London Convention is the main treaty regime that relates to marine pollution. The London Convention requires parties to take effective measures to prevent marine pollution by disposal of wastes into the sea. In fact, the fundamental obligation under the London Convention is to prohibit the deliberate disposal of waste from vessels at sea. However, the application of this convention on the issue of ship breaking is debated. At the time when the convention was set up, the issue of ship breaking was not a problem.

9.4. The International Convention for the Prevention of Marine Pollution from Ships (MARPOL)

MARPOL is the main international convention covering prevention of pollution of the marine environment by ships from operational or accidental causes. It is a combination of two treaties adopted in 1973 and 1978 respectively and updated by amendments through the years.

i. Issues relevant to ship breaking

The MARPOL convention deals with discharges from ships. In the issue of ship breaking MARPOL would apply to the discharges that occur from ships sent for shipbreaking, which take place within the territorial waters of the ship breaking country. Practically this means that once the ship is delivered to a ship breaking yard any discharge, notably of oil or oily mixtures will be prohibited. Such oily wastes must be retained on board or discharged to reception facilities in port. States are in turn obliged to ensure the provision of the necessary reception facilities for these oily discharges. Interestingly MARPOL obliges the person in charge of the vessel to report any actual or probable discharge above the permitted level.

9.5. The United Nations Convention on the Law of the Seas (UNCLOS)

UNCLOS lays down a comprehensive regime of law and order for oceans and seas based

on the principle that all problems of ocean space are closely interconnected and need to be addressed as a whole. The Convention comprises 320 articles and nine annexes, governing all aspects of ocean space, such as jurisdiction of States over maritime areas, economic activities, protection and preservation of the marine environment, marine science and technology and the settlement of disputes relating to ocean matters.

i. Issues relevant to ship breaking

The United Nations Convention on the Law of the Seas (UNCLOS) signatory countries are obliged to establish global and regional rules, standards and recommended practices and procedures to protect the marine environment. It is interesting to note in relation to the issue of ship breaking that there is recognition under UNCLOS of the different role of port states and flag states. Port states have discretion for enforcement within their territorial waters. Flag states are obliged to enforce the international rules and standards, as well as their own pollution laws and regulations, wherever the violation occurs.

9.6. International Maritime Organization (IMO)

The role of IMO is an overall responsibility for coordinating issues associated with ship-recycling and responsibility for monitoring issues arising during ship design, building and operation which may have an impact on recycling, including preparations for recycling on board.

The subject of ship scrapping was brought to IMO's Marine Environmental Protection Committee (MEPC) in 1998, when Norway proposed to add the topic to IMO's agenda. The issue has since been on the agenda at every committee meeting, and a correspondence group (CG) was established at the 44th MEPC session in March 2000; its role consists in:

-Identifying all stakeholders and their perceived roles during the life-cycles of a ship.

-Identifying and elaborating on the role of the IMO in ship recycling.

-Identifying the existing international, national and additional industrial and/or the relevant standards/guidelines, which possibly apply to ship-recycling within the role of IMO.

-Recommending possible courses of action for further consideration by the Committee, and to identify the pros and cons associated with each option.

The IMO drafted guidelines in 2004 on ship recycling under the auspices of its Maritime and Environmental Protection Committee. The Guidelines identify voluntary measures that need to be taken by ship owners as well as by relevant actors in ship breaking countries. The recently developed guidelines are half a step forward in the campaign to clean up the shipping industry. Ships are now required to carry a Green passport specifying the hazardous substances that are on board, and shipbuilders now have to start building clean ships. Greenpeace believes that the IMO guidelines will not at all change the current practices of ship owners. The IMO failed to accept and complement the existing legislations and regulations (mentioned above) dealing with the export of hazardous wastes (Basel Convention).

The guidelines are therefore outside international law. Greenpeace is concerned that the new guidelines could be misused to cover up the illegal business. It is likely that the environment and people in Asia will still continue to be exposed to hazardous substances.

9.7. United Nations Environmental Program (UNEP)

UNEP provides the secretariats for the Basel and Stockholm Conventions. UNEP and the UN Food and Agriculture Organization (FAO) jointly provide the Rotterdam secretariat, which is located in Geneva and in Rome.

UNEP is responsible for the implementation of the Basel Convention. It is currently drafting guidelines on the environmentally sound management for the full and partial dismantling of ships, in order to provide recommendations on procedures and practices to be implemented to attain Environmental Sound Management (ESM) in shipbreaking yards. The guidelines also pro-

vide advice on monitoring and verification on environmental performance. The guidelines are expected to present a "model facility", the realisation of which should be reached within 5 years. These guidelines will "*make provisions for the proper removal of hazardous wastes and substances, including the collection, sorting and disposing/recycling of wastes in an environmentally sound manner*". These guidelines will not, however, cover issues of health and safety.

9.8. The International Chamber of Shipping (ICS)

The aim of ICS to encourage high standards of operation and the provision of high quality and efficient shipping services. It also strives for a regulatory environment which supports safe shipping operations, protection of the environment and adherence to internationally adopted standards and procedures. ICS also promote properly considered international regulation of shipping and oppose unilateral and regional action by governments. ICS also remain committed to the promotion of industry guidance on best operating practices.

i. Issues relevant to ship breaking

ICS took the initiative to establish an "Industry Working Party on Ship Recycling" (IWPSR) 23 in February 1999. The IWPSR established an Industry Code of Practice on ship recycling in August 2001. This Code of Practice is the basis for the IMO's own guidelines. It is aimed at the ship owners, and encourages for the present all shipping companies to initiate and complete a programme to identify and record, as far as is practicable, on each of their existing ships, any potentially hazardous material, as well as to make every effort to minimize the amount of potentially hazardous materials on board the ship.

For the future, it seeks to encourage naval architects and ship builders to take due account of the ship's ultimate disposal when designing and constructing a ship, and suggest the creation of a "green passport" for new ships. Here too, the voluntary and non-enforceable nature of these guidelines seriously weakens their domain and potential effect.

9.9. Stockholm Convention on Persistent Organic Pollutants(POPs)

There has been a significant level of debate on production, transboundary movement and impact of POP's at the international level, particularly during the 1990's. This culminated in the development of the Stockholm Convention on Persistent Organic Pollutants on 22 May 2001; in response to the urgent need for global action to protect human health and the environment from persistent organic pollutants (POPs). This was a major milestone in the efforts to curb the impacts of POPs. At this time, there are 151 signatories and 11 parties to this convention.

The Convention seeks the elimination or restriction of production and use of all intentionally produced POPs (i.e. industrial chemicals and pesticides). It also seeks the continuing minimization and, where feasible, ultimate elimination of releases of unintentionally produced POPs such as dioxins and furans. Stockpiles must be managed and disposed of in a safe, efficient and environmentally sound manner. The Convention also imposes certain trade restrictions. The

chemicals slated for elimination under the Stockholm Convention are the pesticides aldrin, chlordane, dieldrin, endrin, heptachlor, hexachlorobenzene (HCB), mirex and toxaphene, as well as the industrial chemical polychlorinated biphenyls (PCBs).The Convention also seeks the continuing minimization and, where feasible, elimination of the releases of unintentionally produced POPs such as the industrial byproducts dioxins and furans.

The Convention come into effect from 17 May 2004. The Convention website is www.pops.int.

i. Issues relevant to ship breaking activities

The Stockholm Convention (Article 3.2) restricts the import and export of POPs to cases where, for example, the purpose is environmentally sound disposal. It also requires that POPs may not be transported across international boundaries without taking into account relevant international rules, standards and guidelines (Article6.1). The Stockholm Convention requires Parties to take measures to reduce or eliminate releases of POPs from intentional production and use (Article 3), unintentional production (Article 5) and stockpiles and wastes (Article 6). Concepts of Best Available Techniques (BAT) and Best Environmental Practices (BEP) are to be further elaborated by the Conference of the Parties. In implementing the Convention, Signatory Governments will take measures to eliminate or reduce the release of POPs into the environment.

9.10. The Universal Declaration of Human Rights

The Universal Declaration of Human Rights adopted in 1948 specifies in article 25 the right to a standard of living adequate for health and well-being. Reflecting the spirit of this article with reference to the Stockholm Declaration of 1972 as well as the Rio Declaration of 1992, a United Nations Human Rights Commission was set up in 1995. This commission adopted a resolution concerning the adverse effect of dumping of hazardous wastes on the enjoyment of human rights. A special reporter was appointed to further investigate and report. The reporter clearly identified ship breaking as a new aspect of waste trafficking and stated that such ships should be considered hazardous waste.

The issue of human rights in shipbreaking yards came to the attention of the international community in the 1990s through the concerted actions of different non-governmental organizations, above all Greenpeace, trade unions such as the International Transport Workers Federation and the International Metalworkers Federation, and intergovernmental bodies, such as the International Labour Organization. The awful working conditions and the dangers to the health and safety of the workers, publicized by several investigative media reports, led to a public outcry, which in turn generated an international mobilization on the issue. Much of the debate has thus focused on occupational safety and health issues (FIDH, 2002).

9.11. International labour Organization (ILO)

The International Labour Organization is the UN specialized agency which seeks the promotion of social justice and internationally recognized human and labour rights. It was founded in 1919 and is the only surviving major creation of the Treaty of Versailles which brought the League of

Nations into being and it became the first specialized agency of the UN in 1946.

The ILO formulates international labour standards in the form of Conventions and Recommendations setting minimum standards of basic labour rights: freedom of association, the right to organize, collective bargaining, abolition of forced labour, equality of opportunity and treatment, and other standards regulating conditions across the entire spectrum of work related issues.

i. Issues relevant to ship breaking

Under the auspices of the International Labour Organization guidelines have been established to improve the safety and health of thousands of workers in ship breaking yards. The ILO covers workers' occupational health and safety issues, left out by the two other bodies. The 279th session of ILO's Governing Body in November 2000 endorsed the conclusion of the tripartite Meeting on the Social and Labour Impact of Globalization in the Manufacture of Transport Equipment stating that "as a first step, the ILO should draw up a compendium of best practice adopted to local conditions leading to the preparation of a comprehensive code on occupational safety and health in shipbreaking, and that governments should be encouraged to require ships to have an inventory of hazardous materials on board that is updated throughout the life of the vessel".

Basically, the ILO's responsibility is to establish standards of operation for the shore-based activities involved in shipbreaking, i.e. to set norms and standards on working conditions on and around the ship once it is beached. A vast number of already existing ILO Conventions, Recommendations and Codes of Practice could be applied to deal with occupational safety and health issues in the shipbreaking activity Preliminary research has begun on developing a Technical Guide on safety in the shipbreaking industries, in line with ILO's code of practice on occupational safety and health Management Systems.

A draft of the guide being was tested throughout 2002 and finalized in 2003. The practical recommendations in the guidelines are intended for use by all those who have responsibility for occupational health and safety in shipbreaking operations. However, they are not legally binding, nor do they intend to replace national laws, regulations or accepted standards. The ILO recognizes that effective and safe shipbreaking depends on how the vessel is prepared for dismantling (Fig. 21)

a. Relevant ILO conventions and recommendations

Eight ILO Conventions have been identified by the ILO's Governing Body as being fundamental to the rights of human beings at work, irrespective of levels of development of individual member States. These rights are a precondition for all the others in that they provide for the necessary implements to strive freely for the improvement of individual and collective conditions of work

Freedom of association

- Freedom of Association and Protection of the Right to Organize Convention, 1948 (No. 87)
- Right to Organize and Collective Bargaining Convention, 1949 (No. 98)

The abolition of forced labour

- Forced Labour Convention, 1930 (No. 29)
- Abolition of Forced Labour Convention, 1957 (No. 105)

Equality

• Discrimination (Employment and Occupation) Convention, 1958 (No. 111) and Recommedation No. 111

• Equal Remuneration Convention, 1951 (No. 100) and Recommendation (No. 90)

The elimination of child labour

• Minimum Age Convention, 1973 (No. 138) and Recommendation (No. 146)

• Worst Forms of Child Labour Convention, 1999 (No. 182) and Recommendation (No. 190)

b. Conventions and recommendations on occupational safety and health and working conditions

• Radiation Protection Convention, 1960 (No. 115) and Recommendation, 1960 (No. 114)

• Reduction of Hours of Work Recommendations, 1962 (No. 116)

• Guarding of Machinery Convention, 1963 (No. 119) and Recommendation, 1963 (No. 118)

• Employment Injury Benefit Convention, 1964 (No. 121 and Recommendation, 1964 (No. 121)

• Workers' Representatives Convention, 1971 (No. 135)

• Maximum Weight Convention, 1967 (No. 127) and Recommendation, 1967 (No. 128)

• Benzene Convention, 1971 (No. 136) and Recommendation, 1971 (No. 144)

• Occupational Cancer Convention, 1974 (No. 139) and Recommendation, 1974 (No. 147)

Fig. 21 Effective and safe shipbreaking depends on how the vessel is prepared for dismantling (Photo: Reichmann, 2005)

Indeed, it is extremely worrying to note that very little has been achieved to give effect to the implementation and enforcement of these rights, in particular freedom of association and collective bargaining, social protection and welfare provisions, Bangladesh's obligations both under international and national law. As this report will show, the workers are in a situation of total vulnerability and dependence, as well of arbitrariness - with no contract, no union, no job security, they work under the rule of a private individual's will, rather than that of the law or of

general agreed rules. The problem is not so much the lack of legislation - but, as often, the non-enforcement of existing ones, and the weakness of remedies. As the ship breaker engages in a race against the clock to make a profit, any obstacle in the way of a quick dismantling of the vessel is removed - such as firm guarantees for the health and safety of workers, social rights, etc. The problem is aggravated by a climate of fear and intimidation, fuelled by a disproportionate local power for ship breakers, especially noticeable in Bangladesh, which prevents prospective trade unionists from setting up unions, but also journalists and other human rights defenders from investigating the situation in the yards. The oft-reported corruption of the judiciary and of public officials does little to improve the credibility of these institutions in siding with the workers in cases of violation of their rights (FIDH, 2002).

10. Role of Bangladesh government in ship breaking activities

A large number of ministries, departments and other government agencies are involved in the dismantling and recycling of ships. Despite the size of the industry and its dangerous and polluting nature, there is no government institution or specific structure to coordinate the jurisdictions of all the different authorities involved. Though the administrative procedures applying to the import of ships for recycling have changed substantially over the last 30 years.

The first importers did not even require a permit to beach ships on the Bangladesh coast, but today they must obtain permission from a number of different authorities and pay an import duty. The Explosives Department issues a gas-free certificate after theoretically having inspected the ship. The Navy inventories and confiscates all sensitive equipment (radar, electronic navigational equipment, telecommunications equipment, radios, wireless sets, walkie-talkies, transreceivers, engines etc.). Meanwhile, the Mercantile Marine Department conducts surveys to check the safety measures taken and also checks the marine stores and a list is prepared.

The Mercantile Marine Department surveyors also verify all the documents of the vessels. The Customs inspect the ship and its cargo and collect the import tax. Finally, once all the administrative formalities have been completed (which according to a number of owners who were asked about it can take about a week). The Port officials before towing the vessel verify the import documents, document on payment of duties/ taxes and certificates issued by the concerned Government authorities. One Deck Officer and one Certified Engineer, in addition to the Master of the vessel need to be present during beaching operation of a ship. The Chittagong Port Authority issues a permit for the ship to enter territorial waters and be beached. The ship's captain puts the ship in position off the coast and waits for the ideal time to perform the beaching maneuver.

Although the Ministry of Ports and Shipping and Ministry of Industries are the two separate Ministries directly responsible for monitoring and supervising the ship breaking activities, the following Government and Non-Government bodies are also concerned with ship-breaking activities:

1. Ministry of Industries
2. Ministry of Labour and Employment
3. Department of Customs
4. Bangladesh Navy
5. Inland Water Transport Authority
6. Chittagong Port Authority
7. Radio Communication and Wireless Control Authority
8. Shipping Masters Office
9. Importers (Who import vessels for breaking)
10. The Breaking Yard Owners and Breakers
11. Survey Authority
12. Survey companies
13. Banks & financial Institutions

14. Shipping Agents

15. Steel Re-Rolling Mills Owners

16. Traders

The Ministry of Ports, Shipping and Inland Water Transport Authority and the Ministry of Industries and Commerce are in command of the import and beaching of ships. The Department of Inspection for Factories & Establishment of the Ministry of Labour and Employment is responsible for registration of the yards as factories. In addition to that The Department of Inspection has also responsibilities for ensuring occupational health & safety, safe-working conditions, working hours , leave with pay, holiday etc. of the shipbreaking workers. The Department of Labour works for workers welfare, trade union rights and industrial relations etc.

The Ministry of Labour and Employment and its subordinate officers are liable for the enforcement of labour laws and ensure welfare of the workers. The Department of Inspection is responsible for ensuring the implementation of the Provisions of the Factories Act 1965 and the rules made there under. The level of enforcement of the Factories Act and Labour Laws in the ship breaking activities is not at all satisfactory.

11. National and international concerns on ship breaking activities in Bangladesh

As Bangladesh is one of the largest countries in respect of ship breaking activities and the subsequent impact on the environment and violation of human rights in the ship breaking yards drew the attention of different concerned bodies round the world as well as within Bangladesh. Electronic and print media; civil society, human rights organizations in seminar and workshop expressed their worries about serious violation of human rights in this sector.

Since 1998, Greenpeace has drawn attention to the poor conditions of ship breaking yards in Bangladesh. They have published several reports, describing the various aspects of ship breaking activities. Still now online resources of Greenpeace are one of the vital sources of information about ship breaking activities.

In 1999, International Labor Organization (ILO) published a report entitled “Ship breaking” describing the working condition, safety issues and other hazards involved in ship breaking in Bangladesh. In this report author Ataur Rahman and AZM Tabarok Ullah mentioned that there was no arrangement for safety of labor. No lifting process is available to load or move the heavy iron pieces. All these risky and tedious works are done by unskilled labor of the yards. Moreover there is no protection tool like gogles, boots, gloves or uniforms. The ships are beached without making the ship gas free. As a result human causalities and environmental pollution is the outcome of ship scrapping activities in Bangladesh.

In 2000 a report was prepared by Morton Ronning named “Stuck in mud: On Ship Breaking, Labour Conditions and Environment in Chittagong,Bangladesh” In this report Ronning described the status of ship breaking, horrible working environment, poor wages, lack of working security, accommodation as well as negative impact of ship breaking on the environment.

The International Federation for Human Rights (FIDH) is an international non-governmental organization dedicated to the worldwide defense of human rights as defined by the Universal Declaration of Human Rights of 1948. In December 2002 the organization published a report with title “Where do the floating dustbins end up? Labour Rights in Shipbreaking Yards in South Asia: The cases of Chittagong (Bangladesh) and Alang (India)”. In this investigative report a general overview of the hazardous dismantling process, labor rights implications and its violations in Bangladesh and the opinion of different stakeholders of ship breaking activities in Chittagong was given.

In 2000, DET NORSKE VERITAS (DNV) of Norway published a comprehensive report based on a onsite assessment. In this report various level of different pollutants originating in the ship breaking area of Chittagong were analyzed and made a comment on the status of pollution in that area. The report concluded with a set of recommendations for the establishment of guidelines for the ship-breaking process based on a Best Practice Approach. Besides, a number of International Organizations like ILO, IMO, UNEP etc are concerned about the ship breaking activities of Bangladesh.

In addition to international organizations a number of NGOs are very interested in the industry, focusing especially on working conditions in the case of the Bangladesh. Young Power in Social Action (YPSA) a voluntary social development organization conducted a baseline survey (2005) to focus on the socio economic condition of the ship breaking workers of Chittagong ship breaking area. All the data appeared in a book entitled “Workers in ship breaking Industries: A base

line survey of Chittagong (Bangladesh)". They also highlight the up to date information concerning ship breaking activities. Now the organization is working to formulate a work plan for the sustainable livelihood of ship breaking workers.

Coastal Association for Social Transformation Trust, an NGO working in the coastal area of Bangladesh, published a report named "Ship breaking Industry: Bangladesh Perspective" giving emphasis on the impacts of ship breaking industry on social, economic and natural environment of Bangladesh. Bangladesh Environmental Lawyers Association (BELA) a legal aid clinic is also concerned with the labor rights and working environment of the ship breaking activities. They sent legal notices to owners of scrapped ship about accidents but no reply has been received as yet (2005).

12. Recommendation for sustainable practices of ship breaking activities

Considering the positive role of ship breaking in national economy ship breaking can not be stopped. Rather a sustainable approach should be taken to minimize the negative consequences of ship breaking activities in our coastal zone. However, following steps may be taken for sustainable practice of ship breaking activities in Chittagong coastal area:

1. Government should formulate and implement a national policy and principles for safe and sustainable shipbreaking after having consultation with relevant organizations, employers and workers.
2. Government should include this sector under the ministry of industry defined by the Factory Act, 1965 and formulate a policy so that, worker's rights and welfare; occupational safety & health (OHP) could be ensured and it could be eco-friendly as well.
3. As Fauzdarhat has been earmarked for recreational facilities in the Master Plan of Chittagong, the Master Plan is to be revised till a final study is made by the experts on the impact of ship breaking being developed in its present site.
4. a) A gas free certificate (in true sense) must be obtained before any ship is broken. Oil must be removed and the oil tanks must be thoroughly cleaned either chemically or manually and the ship breakers must obtain a tank clearance certificate from the Mercantile Marine Department before beaching.

   b) Vessels must pump out maximum possible quantity of oil at the anchorage before beaching. All the oily sludge, rags, rust, sawdust etc. must be removed and disposed of at a safer place.

   c) Vessels causing Marine Pollution by spill, over-flow or dumping of oil or oily sludge etc. will be liable to be prosecuted under Bangladesh Marine Pollution Ordinance.

   d) A systematic and periodic inspection of the whole yard should be done before a certificate of compliance is issued by the Department of Environment (DoE) & Department of Shipping for control of pollution during ship breaking.

   e) Waste reception facilities with safe management for hazardous materials to be established.

   f) Global ship recycling fund should be established by the contribution of stakeholders involved to expedite safe ship recycling for Bangladesh and other ship breaking countries, with transfer of technology and training from relevant international organizations.
5. The sea shall be kept undisturbed as far as practicable for healthy growth of marine biodiversity and human health. Because, many of the ship-breaking components are highly toxic, persistent and carcinogenic in nature and they prove fatal for aquatic food chain & human health. Therefore,

   a) Short and long term scientific study should be immediately started to assess the impacts of ship breaking activities on coastal water, soil and fishery resources, as well as human health.

   b) To mitigate the problems and environmental impacts, cooperation & collaboration among scientists, policy makers, owners, local representatives, N.G.O,s, media and different stakeholders must be achieved through consultation, seminars, discussions etc.

6. No ship breaking licenses should be issued to any one unless he produced requisite permission showing that necessary lease of land had already been taken for the purpose.
7. Fire stations and hospitals should be setup near to the yards, for the welfare of the workers and avoiding severe loss by any accident.
8. The authority should select a "certain isolated and protected scrapper's yard" for dismantling the ships instead of the seashore areas.
9. The ship breaking activities should be carried out in a planned and hygienic way. A layout should be designed before starting to break the ship.
10. For sustainable ship breaking policy and its implementation, linkage with international organizations and NGOs; interagency cooperation, strengthening capacity building of the relevant government department through training is must.
11. Full respect and effective implementation of the international and national norms, and most notably the Trade Unions Act (1926) and the Factories Act (1948), related to labour rights and particularly, freedom of association and the right to collective bargaining, just and favorable conditions of work (minimum salary, overtime payment, salary deductions, working hours, holidays and benefits, weekly rest…) should be ensured.
12. Ship breakers or owners should provide PPE (personal protective equipment) in general and appropriate PPE in specialized cases for workers and labors.
13. Both owner and contractors have to take the responsibility in providing compensation, treatment and security for the labours. Adequate compensation for victims of accident and their families, social security…etc. should be ensured.
14. IMO, ILO & Basel convention guidelines are not yet mandatory. So, for sustainable practices these guidelines should be translated into laws and procedures pertaining to the sustainable ship breaking activities in Bangladesh.

Finally, it could be said that, the ship breaking operation involves serious environmental hazards. If the ship breaking industry is to develop in the country, the same may only be allowed ensuring minimization of pollution effect. A longer stretch along the seashore is in no way justified for continuation of this business, rather a certain separate zone like a dockyard should be selected by the competent authority. Preventive measures against environmental and health hazards inherent in the process of ship breaking, should be undertaken at the right time, before it is too late.

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Author's in brief

Md. M. Maruf Hossain

Md. M. Maruf Hossain, Ph.D is a Professor and former Director, Institute of Marine Sciences, University of Chittagong, Bangladesh. Professor Hossain did his M Sc. in Marine Biology at the University of Chittagong in 1983 and later an M. S. in Marine Ecology from Vrije University, Belgium in 1990. He did his Ph. D (Environmental Science) from the University of Science, Malaysia (USM) in 2002. He has completed a number of training course on Environment and related issues in home and abroad and had PGT on 'EIA & its Management' from the University of Aberdeen, Scotland & AIT ,Thailand and on 'Environmental Dynamics' University Di-Venezia, Italy. His field of specialization and research area is in Aquatic Pollution, EIA, Ecotoxicology and Marine Biodiversity Conservation. Besides teaching and supervise post-graduate research students in the field of 'Environmental Pollution' and 'EIA' Professor Hossain served as Principal Investigator in Environment related project funded by DFID-SUFER Project, UK, Ministry of Science & Technology, Malaysia, IAEA/BAEC, UGC, Ministry of Science and Technology,GoB. He also worked as National Consultant in UNEP, BOBP/SWEDMAR, BOBLME/FAO, MoEF of GoB. He is a fellow of IMO and recipient of a UN/IMO fellowship under the "Global Protection of Marine Environment". Professor Hossain has published a good number of research paper in well recognized journal and books and presented in scientific seminars held in home and abroad. He is actively involved with different Environment and Biodiversity group and organizations.

Mohammad Mahmudul Islam

Mohammad Mahmudul Islam was born in Kishoregonj. He did his B Sc. (Honor's) degree in Marine Science from the Institute of Marine Sciences, University of Chittagong and was placed first class first position in order of merit. He completed his Masters degree from the same Institute securing first class first position, where his research thesis focused on the exploitation and management of fisheries resources in Chittagong coastal area, Bangladesh. He has participated in a number of training programs and worked in different research projects. Mr. Islam is awarded a NORAD fellowship for higher studies in International Fisheries Management in Norway. He is aiming to build his career in environment and marine resources management.