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*Full Length Research Paper*

# Health hazards and risks vulnerability of ship breaking workers: A case study on Sitakunda ship breaking industrial area of Bangladesh.

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Ship breaking activities are facing both challenges and opportunities for coastal zone management in a holistic manner with increase of its demand of raw materials for re-rolling mills and other house hold purposes inspite of various negative impacts on coastal environments in Chittagong region of Bangladesh. An attempt has been taken to find out the socioeconomic condition and health hazard risks of workers due to ship breaking activities at the Sitakunda ship breaking industrial area in Chittagong region of Bangladesh. The present study was carried out based on the combination of primary and secondary sources of data during the period of September 2012 to August 2013. The socio economic condition of the ship breaking workers indicated that most of the workers are working at the ship yards with low facilities, risky and vulnerable by health and diseases. It is observed from the survey that most of the workers came from poverty stricken regions of Bangladesh, where opportunity of employment is very poor or less. The survey revealed that 59.59% workers are migrated from different districts and 40.40% workers are permanently living in the study area or the Chittagong. The observed common hazards of hazards and risks of ship breaking activities are divided into five categories namely; Serious accident related hazard, Physical hazards, Mechanical hazard, Biological hazard and Ergonomic and Psychological hazard on workers as well as residences nearest the breaking yards in the study area. Considering the positive role of ship breaking in national economy ship breaking can not be stopped. So, a sustainable approach should be taken to minimize the negative consequences and impacts of ship breaking activities in our coastal zone as well as in the study area.

**Keywords:** Ship breaking, Hazards, Vulnerability, Sitakunda, Bangladesh.

## INTRODUCTION

Ship breaking is the process of dismantling an obsolete vessels' structure for scrapping or disposal. It includes a wide range of activities, from removing all gears and equipment to cutting down the ship's infrastructure by conducted at a pier or dry dock or dismantling ship. Ship breaking is a challenging process due to the structural

complexity of ships with many environmental safety and health issues are involved (OSHA, 2001). The ship breaking activities are being practiced in the coastal areas of Bangladesh and have gained importance in the macro and micro-economy of poverty stricken Bangladesh. Increasing demand of raw materials for re-rolling mills and

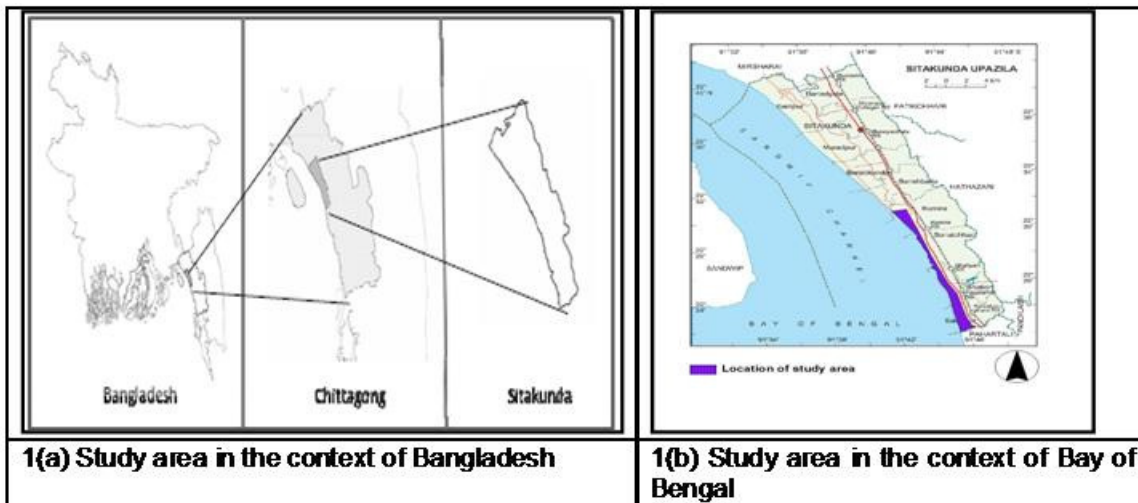
other purposes and negative impacts on our coastal environments, ship breaking activities present both challenges and opportunities for coastal zone management in a holistic manner. These activities exemplify both the potentialities and the dangers of an increasingly globalized economy. This activity began in 1969 and since then it has earned a good reputation for being profitable by the cost of environmental degradation (Hossain and Islam, 2006). 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. Since the last 20 years more than 400 workers have been killed and 6,000 were seriously injured (ibid). Due to unconsciousness and lack of government patronization, these activities are facing several internal and external problems. Considering all these facts, a distinct and well-balanced policy is necessary for sustainable ship breaking activities in the context of Bangladesh. To assess the various impacts of ship breaking industry including local environment and health of the workers, this type of research or study is urgently needed for the conservation of environment as well as for implementation of a sustainable ship breaking policy to progress this activity should be carried out in a planned and hygienic way in Bangladesh.

In this perspective, Ship breaking and recycling can be claimed to be a sound sustainable industrial activity. The material composition of a vessel structure, components and systems will reflect the era from when it was built. Similarly, the cargo remains system agents, onboard spares and other consumables will reflect its type and pattern of trade. At the end of operational life, the ship still represents a resource, as a considerable proportion of its lightweight is suited for reuse or recycling. It supplies a substantial quantity of scrap metal for the iron and steel industries as well as it creates job opportunity. The tightened environmental regulations in industrialized countries result in an increase in the cost of disposing of hazardous waste. Subsequently, this led to so-called 'toxic traders' exporting hazardous waste to developing countries where the environmental regulations are less stringent with low labor costs, weak regulations on occupational safety, and limited environmental enforcement. This 'global shift' in the industry to countries with comparatively weaker regulatory systems is of particular concern as ships contain many hazards that can have significant detrimental effects on humans and the environment if not dealt with properly. In Bangladesh, ship breaking industry has been turned into a promising sector and has contributed to considerable economic growth. This activity began in 1969 and since then it has earned a good reputation for being profitable but at a great environmental cost (Karim, 2010). 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. The area is severely degraded with loss of its physical, chemical and biological characteristics. However, the extraction processes required, produce debris and wastes that themselves represent a threat to the environment and consequently to human health. Further, the methods adopted in the extraction and demolition processes are suffering from some deficiencies regarding some safety aspects related to the environment and workers. With a view to ensuring this safety, these extraction and demolition processes require sustainable development in terms of managerial routines. Bangladesh needs 8 million tons of building materials per year, of which iron is a major component. Moreover, every year the Government collects about 900 crore Taka (BDTk.) by revenue from ship breaking industry through import duty, yard tax and other taxes (ibid). Considering the increasing demand and the levels of profitability, it is clear that there is a scope for developing more sustainable practices in Bangladesh.

**A brief history of Ship breaking activities:** Until the 1960s, ship breaking activity was considered as a highly mechanized operation that was concentrated in industrialized countries, namely in the United States of America, the United Kingdom, Germany and Italy. The UK accounted for 50% of the industry in Scotland to run the largest ship breaking operation in the world (Singh, 2001). During the 1960 to 1970, ship breaking activities were migrated into the semi-industrialized countries like Spain, Turkey and Taiwan due to the available and cheap labour and the existence of re-rolling steel market (ibid). In the 1970s, it left Europe and established itself in Asia, first in Taiwan and South Korea, and then in China, Bangladesh, India, Pakistan, Philippines and Vietnam. From the early 1980s to maximum profits ship owners 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 (Karim, 2010). 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 in the Asian yards. The Alang of 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).

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 (Salim, 2009). In 1974, the Karnafully Metal Works Ltd. was bought as scrap which is fully considered as the introduction of commercial ship breaking in Bangladesh. Ship breaking is a potential industry for Bangladesh. At present the position of Bangladesh is ranking in third position in the world for



**Map 1. Location of the study area.**  
Source: Banglapedia, 2008

ship breaking. After the independence of Bangladesh (during the 1980) the ship breaking activities was introduced as commercial activities in Bangladesh. Very recently, the Prime minister of Bangladesh has declared the ship breaking activities will be treated as an industry in Bangladesh.

## MATERIALS AND METHOD

In the present research the methodology is designed as selection of the study area, objectives, sources of data (both primary and secondary), sampling technique and data collection procedure, data analysis and statistical procedure are stated below.

**Selection of the study area:** The ship breaking yards in Chittagong range are mainly located along 7 km. long coastline of Sitakunda Upazila. Most of the ship breaking yards of Bangladesh are situated in different locations namely Fultola, Baro-Awlia, Kadam-rasul, Jahanabad, Kumira, Kattoli union under Sitakunda Upazila of Chittagong District. At present there are about 48 ships breaking yards (36 yards are active and 12 yards are closed) are laying along Dhaka-Chittagong highway which is 10 km. away from the Chittagong city. That's why; the Sitakunda Upazila has been taken for the present study (Map. 1).

## OBJECTIVES OF THE STUDY

The main aim of the present study is to find out the livelihood conditions and health hazard risks of workers

Sitakunda ship breaking industrial area due to ship breaking industry. The specific objectives are given follows:

- 1 To find out the socioeconomic condition of workers in the ship breaking industrial area.
- 2 To asses the major health hazards and risks with vulnerability of workers due to ship breaking activities in the study area.
- 3 To find the relationship between vulnerability of health hazards and existing socio-economic environmental conditions of workers in the ship breaking industrial area.
- 4 To draw a comprehensive suggestions as a recommendation for sustainable ship breaking industrial activities in the study area.

## Data sources and analysis procedure

The present study was carried out based on the combination of primary and secondary sources of data. The primary data were collected from various ways namely; direct field observation survey, focus group discussions (FGD), questionnaire survey and expert opinion survey during the period of September 2012 to August 2013. There are four FGD have been conducted namely A, B, C and D groups. The group members were chosen from worker and labour, customer, local victims resident and as possible as owner association in the study area. There are about 400 questionnaires were conducted from different stake holders to find out the vulnerability and present condition of workers in the study area. All the questionnaires were conducted from door to door and face to face. To know some technical aspects and health impacts of ship breaking related activities almost ten

experts opinion survey have been incorporated in the present study. Secondary data were taken and incorporated from different books, journals, daily news papers, magazines, data from City Corporation, CDA, GO and NGO's reports and various published and unpublished materials from different researchers regarding this field. Data collected from the field and secondary sources are imputed and analyzed by MS Word, MS Excel and Statistical Package for Social Science (SPSS). Pearson's product moment correlation ( $r$ ) formula is used to test the null hypotheses and to check out the relationships between the independent and dependent variables by following the method of Islam (2011). Later these are presented by tables, charts, graphs, diagrams, figures and photographs etc. with the help of SPSS, MS Word and MS Excel.

## RESULTS AND DISCUSSION

### 1. Categories of ship breaking workers

Two major categories of workers are found related to ship breaking activities in the study area namely, i) Regular workers and ii) Casual workers.

**i) Regular workers:** The regular employees and workers are treated as the permanent categories and they are paid monthly wages including household allowance, medical allowance and convergence allowance. This category is also paid on extra allowance for overtime work. They are also divided as follows:

- **Foremen:** Foremen are the leader of the workers group and also supervise different problems of workers. They usually supply workers to the ship yards from the different places.

- **Filters:** They are engaged to dismantle important parts, pipes, hardware, and metal into the vessels.

- **Gas cutters:** These are the most skilled workers and the best paid but they are also the most exposed to the risk of explosions which are frequent. The gas cutters work with gas torches.

- **Crane operators:** They operate the cranes to load and unload.

- **Truck drivers:** They usually transport the materials from one place to another.

- **Rhythmic callers/ singers:** They usually engaged on singing to synchronize steps of the group of casual workers while carrying heavy steel plates and pipes from one place to another during the ship breaking.

**ii) Casual workers:** These types of workers are included various types of labours paid by daily basis and work under the contractor's supervision in the ship breaking yards. The major characteristics and activities of these groups are follows:

- A portion of group is engaged to operate on board to remove everything that can be removed before cutting commences.

- A portion of group is in charge of chains and cables moves into the ship, especially with winches, from the point where the ship was beached to the worksite.

- A portion of group is engaged for filling oil empties the ship of remaining fuels and hydrocarbon residues (in the case of tankers) and stores them.

- A portion of group is engaged as sweepers to remove mud from all slices or segments of the ship.

### 2. Socio-economic conditions of ship breaking workers

To assess the socio economic condition of the workers five parameters are considered in the present study namely, Gender, age, education, occupation and monthly income of the workers in the study area. The socio economic condition of the ship breaking workers is shown in the following Table 1.

It is observed from the above Table 1 that the male respondents are dominated on the survey. The above table also indicated that about 14% are illiterate followed by primary (27%), SSC (20.5%), HSC (16%) and above degree passed are constituted about 22.5% in the study area (Table 1). In this context, 45.5% people are found as labours and 20% are also observed as ship breaking materials business in the present study (Table 1). On the other hand, on third peoples (30%) are earning money monthly 5000-7000 Taka (Table 1).

**(i) Housing pattern of the workers:** It is observed from the survey that most of houses (44.44%) of the ship breaking workers are tin-fence and followed by 26.26% houses are *Semi-pacca* *Semi-pacca* means made by Brick and Tin shade, 20.20% houses are *Kacha* *Kacha* means made by soil, bamboo and temporary shade and 9.09% houses are *Pacca* *Pacca* means made by concrete and rod with roof. (Figure. 1). It may be stated that ship breaking workers are living poor housing with unhealthy environment. The following fig.1 has shown as the housing pattern of the ship breaking workers in the study area.

**(ii) Sanitation system of the workers:** It is observed from the survey that most of toilet systems (37%) of the ship breaking workers are used to tin-fence as *Kacha* latrines, 27% are used to *Semi-pacca*, 22% are used to *Pacca* and 4% workers are used to open space for their toilet which is not hygienic (Figure. 2). The following figure.3 has shown as the sanitation system of the ship breaking workers in the study area.

Table 1. Socio economic characteristics of the ship breaking workers in the study area

Gender			Age			Education			Occupation			Monthly income (Tk)		
Sex	f	%	Age interval	f	%	Educational level	f	%	Occupation	f	%	Income range	f	%
Male	278	69.5	21-30	42	10.5	Illiterate	56	14.0	Services	90	22.5	> 1000	32	8.0
Female	122	30.5	31-40	136	34.0	Primary	108	27.0	Business	80	20.0	1000-3000	64	16.0
<b>Total</b>	<b>400</b>	<b>100</b>	41-50	176	44.0	S.S.C	82	20.5	Student	30	7.5	3000-5000	96	24.0
			51-60	30	7.5	H.S.C	64	16.0	Laborer	182	45.5	5000-7000	120	30.0
			60+	16	4.0	Degree	52	13	Housewife	16	4.0	7000-9000	56	14.0
			<b>Total</b>	<b>400</b>	<b>100</b>	Masters	38	9.50	<b>Total</b>	<b>400</b>	<b>100</b>	9000+	32	8.0
						<b>Total</b>	<b>400</b>	<b>100</b>				<b>Total</b>	<b>400</b>	<b>100</b>

Source: Questionnaire survey ( Here; f = Number of respondents as frequency)

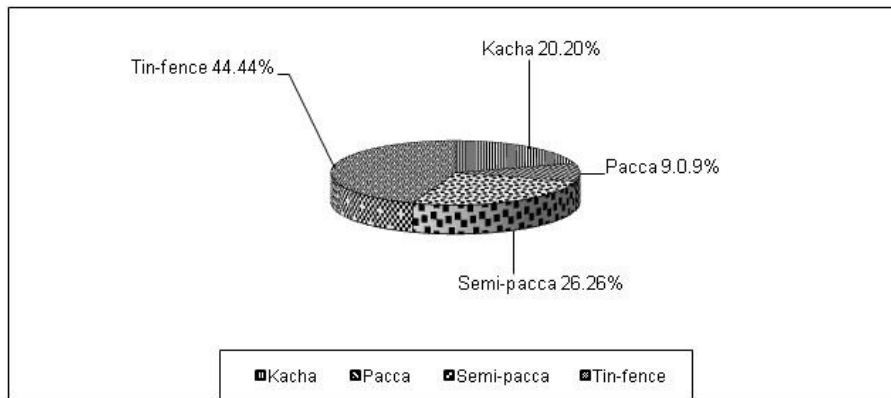


Figure 1. Housing pattern of the ship breaking workers in the study area (Source: Field Survey).

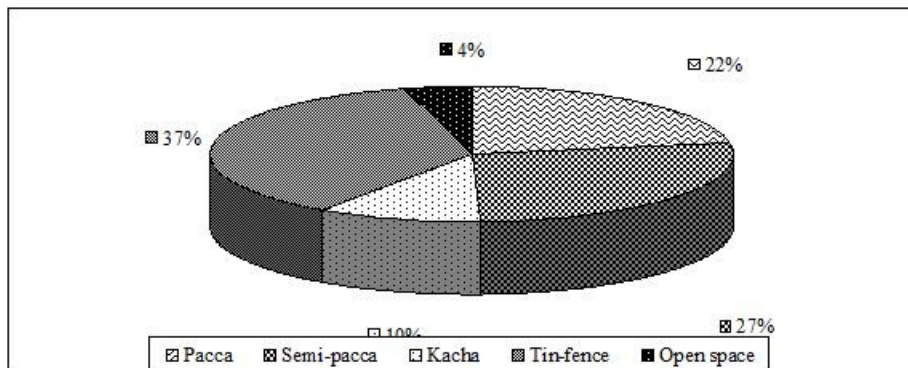


Figure 2. Sanitation systems of the ship breaking workers in the study area (Source: Field Survey)

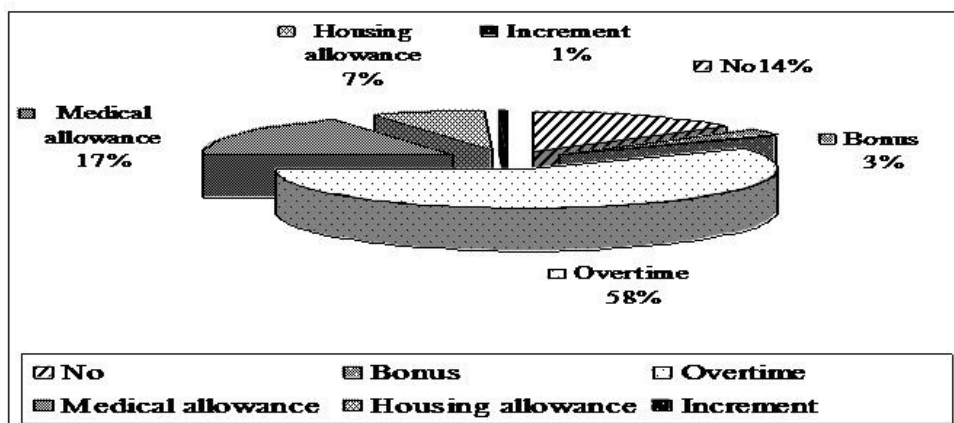


Figure 3. Financial facilities and advantage of the ship breaking workers in the study area. (Source: Field Survey)

Table 2. Satisfaction level of workers on five essential parameters

Items of Satisfaction	Satisfaction (%)	Un-satisfaction (%)	Acceptable (%)	Poor (%)
Food	21.12	37.37	38.39	3.03
Clothing	13.13	42.43	40.40	4.04
Living place	12.12	32.33	30.30	25.25
Education	5.05	38.39	36.36	20.20
Medical	4.04	40.41	30.30	25.25

Source: Field Survey

(iii) **Financial facilities and advantage of workers:** It is observed from the survey that though majority workers expressed (58%) are getting overtime by their hard work but 17% workers informed that the owners' authority provides minimum medical allowance while 14% workers didn't get less or no financial facilities (Figure.3). The following figure.3 has shown as the financial facilities and advantage of the ship breaking workers in the study area.

(iv) **Satisfaction level of workers:** In Bangladeshi context, there are five parameters are well known human rights namely; food, clothing, education, living place and medical facilities which are also our constitutional rights. The following Table 2 has shown as the financial facilities and advantage of the ship breaking workers in the study area.

It is observed from the above Table 2 that huge portion workers are unsatisfied on food (37.37%), clothing (42.43%), living place (32.33%), education (38.39%) and medical facilities (40.41%) in the study area. On the other hand a little portion are observed as satisfied on food (21.12%), clothing (13.13%), living place (12.12 %), education (5.05%) and medical facilities (4.04%) in the study area (Table 2 ).

### 3. Health hazards risks with vulnerability on health of ship breaking workers

i. **Health hazards risks of workers:** It is observed from the study that majority workers fell several health hazard risks and vulnerable due to working in the unhealthy and noxious as well as risky environment round the clock in the study area. The major health hazard risks on the ship breaking workers which are observed from the present study have shown in the following Table 4.

It is observed from the above Table 3 that direct physical like Loss and breaking of body organs is vastly affected and huge vulnerable (23.19%) followed by Spot death (17.39%), Skin diseases (15.94%), Physical weakness, Gastric problem (11.59%), Muscle and chest pain (10.72%), Problem of eyesight and headache pain (8.84%) and Breathing difficulty, cold and cough (7.54%) types of hazards related to ship breaking activities in the study area (Table 3).

ii. **Types of hazards and risks due to ship breaking activities:** It is observed from the survey that on an average at least a worker died or injured at the spot yards during the working period in every week in the study area.

**Table 3. Major health hazards risks of the workers in the study area**

SL no	Types of health hazards	Frequency (f)*	Percentage (%)
01	Loss and breaking of body organs	320	23.19
02	Spot death	240	17.39
03	Problem of eyesight and headache pain	122	8.84
04	Breathing difficulty, cold and Cough	104	7.54
05	Skin diseases	220	15.94
06	Physical weakness, Muscle and chest pain	148	10.72
07	Diarrhea and water deficiency	66	4.78
08	Gastric problem	160	11.59
	<b>Total</b>	<b>1380</b>	<b>100.0</b>

Source: Questionnaire survey, \* Multiple answers are considered

**Table 4 Types of hazards and risks of ship breaking activities in the study area**

SL no	Category of Hazards	Mechanisms of hazards
01	<b>Serious accident related hazards</b>	• Fire and explosion by explosives flammable materials
		• Being stuck by falling materials
		• Compressed between heavy materials
		• Snapping of cables, ropes, chains, slings
		• Handling heavy objects; poor access to progressively dismantled vessels (floor, stairs, passage ways)
		• Falls from height inside ship structures or on the ground
		• Stuck by moving objects
		• Slipping on wet surfaces
		• Sharp materials
		• Oxygen deficiency in confined spaces. Lack of PPE, housekeeping practices, safety signs
02	<b>Physical hazards</b>	• Noise pollution
		• Extreme temperatures
		• Vibration
		• Poor illumination
03	<b>Mechanical Hazards</b>	• Trucks and transport vehicles
		• Scaffolding, fixed and portable ladders
		• Impact by heavy an sharp-edged tools
		• Power-driven hand tools, saws, grinders abrasive cutting wheels
		• Shackles, hooks; chains
		• Cranes, winches, hoisting & hauling equipment;
		• Lack of safety guards in machines
• Poor maintenance of machinery and equipment.		

Table 4. Continue

04	Biological hazards	• Toxic marine organisms
		• Risk of communicable diseases transmitted by pests, vermin, rodents, insects and other animals that may infest the ship
		• Bitten by insects, snakes and others
		• Infectious diseases (TB, malaria, dengue fever, hepatitis, respiratory infections etc.)
05	Ergonomic and Psychological hazards	• Repetitive strain injuries, awkward postures, repetitive and monotonous work, excessive workload.
		• Long working hours, shift work, night work, temporary employment
		• Mental stress, strained human relations (aggressive behavior, alcohol and drug abuse, violence)
		• Poverty, low wages, under age, lack of education and social environment.

Source: Questionnaire survey

Table 5. Factors of ship breaking activities with health hazard risks on workers

SL no	Responsible factors	Percentages (%)
01	Toxic gas explosion, Toxic oil	28.5
02	Not used of life safeguard equipments	19.0
03	Heat/ warm condition	4.0
04	Polluted environment at ship breaking yards	7.0
05	Emit spark/ fire band	3.0
06	Too much working pressure and heavy work load	6.0
07	Carefulness	4.5
08	Lack of training	8.5
09	Noise, Air and water pollution	7.5
10	Dust and sand	2.0
11	Smoke	3.0
12	Risky works	5.5
13	Unhygienic food and Unhealthy toilet in the yards	6.0
14	No responsibly of owners and contractors	3.5
<b>Total</b>		<b>100.0</b>

Source: Questionnaire survey

The observed common hazards of hazards and risks of ship breaking activities are divided into five categories namely, serious accident related hazards, Physical hazards, Mechanical hazards, Biological hazards and Ergonomic and Psychological hazards on workers as well as residences nearest the breaking yards in the study area. A list of common hazards due to ship braking activities among ship breaking workers are cited in the following Table 4.

It is observed from the above Table 4 that several mechanisms area vastly responsible and associated on above mentioned types of hazards on direct workers and local habitants in the study area. Salim (2009) had observed that many factors and issues area correlated on ship breaking accident at Sitakunda ship breaking industrial area.

**iii. Factors behind hazards of ship breaking activities:**

There are many responsible factors of health hazard risks are found in the ship breaking activities due to risky environment round the clock in the study area. Moreover, maximum workers are not used of life safeguard equipments which are identified as responsible factor with risks. Toxic gas explosion and pollution is another most important factor of health hazard risks. That's why; most of the accidents are caused by toxic gas explosions. Another cause of accident is found from the survey that the fall of heavy metal plates from upper decks and crushed by falling steel beams and plates and electric shocks during cutting and transporting of breaking materials from the vessel. A list of responsible factors of ship breaking activities with health hazard risks on workers which are found from the survey have shown in the following Table 5.



**Table 6. Mentionable useable materials or equipments from scrapped ships**

SL. No.	Name of Materials	SL. No.	Name of Materials
1	Iron and Steel	15	Plastic
2	Electrical Equipments	16	Life Boat
3	Machineries	17	Oil
4	Furniture	18	Oil Separator
5	Cool Store Items	19	Hardware
6	Propeller	20	Chemicals
7	Boiler	21	Toiletries
8	Cable	22	Paints
9	Kitchen Materials	23	Navigation Equipments
10	Generator/Motor Pump	24	Insulation Materials
11	Refrigeration	25	Batteries
12	Wings Machine	26	Metals
13	Tank	27	Pipe
14	Rope		

Source: Field survey

It is observed from the above Table 5 that toxic gas explosion and toxic oil (28.5%) is the most responsible factor observed by the survey followed by Not used of life safeguard equipments (19%), Lack of training (8.5%), Noise, Air and water pollution (7.5%), Polluted environment at ship breaking yards (7%), Too much working pressure and heavy work load (6%), Unhygienic food and Unhealthy toilet in the yards (6%), Risky works (5.5%), carefulness (4.5%) and heat or warm condition at yards( 4%) are treated factors according to respondents opinions in the study area (Table 5). FIDH (2002) found similar several factors of ship breaking activities at Sitakunda in Chittagong.

**iv. Useable materials or equipments from scrapped ships:** It is observed from survey that at present, about 36 yards are continuing to scrap ships and vessels and 50-60 ships are scrapped in every year in those yards in the study area. The main sources for purchase of unserviceable vessels are the former USSR, Bulgaria, Russia, Rumania, Greece, Italy, Turkey, Japan, Singapore, South Korea etc. There are many materials or equipments come from scrapped ships. The most usable and mentionable things are given below in the following Table 6.

#### 4. Problems of workers regarding ship breaking activities

In Bangladesh, all the works of cutting to loading are conducted manually are observed in the study area. That's why; many workers are dying in accidents through gas-

explosion, toxic gases, iron plates or sheets fall down from the top of the ships. The observed major problems and limitations of ship breaking workers in the study area are shown in the following Table7.

It is observed from the above Table 7 that 16.33 % people feel this types of works is very hard and risky, followed by Health problems and skin diseases (15.10%), Low wage/ salary (14.97%), Absence of security on life (9.66%), No job security (8.98%) and Absence of life insurance (8.84%), Absence of hospital near ship yards (8.16%) context of ship breaking activities in the study area. The other mentionable problems fell by the workers in this activities are Lack of sanitation systems, Absence of related training system, Lack of pure drinking water, Lack of recreation facilities of workers in the study area (Table 7).

#### 5. Relationships between hazards and existing socio-economic conditions of workers

This portion of the present study has designed in accordance to findings of the various correlations values with discussion of relationships between vulnerability of health hazards and existing socio-economic conditions of workers.

**Variables used for correlation coefficient in the present study:** In the present study, various parameters and factors of ship breaking activities are used in order to compute the correlation matrix. The variables are considered to analyze of correlation coefficients in the context of project topic has shown in the following Table 8.

**Table 7. Major problems and limitations of the ship breaking workers**

SL no	Types of problems	Frequency (f)*	Percentage (%)
01	Very hard work and risky job	240	16.33
02	Low wage/ salary	220	14.97
03	Absence of security on life	142	9.66
04	Lack of pure drinking water	88	5.99
05	Absence of hospital near ship yards	120	8.16
06	Lack of sanitation systems	102	6.94
07	Health problems and skin diseases	222	15.10
08	Absence of related training system	90	6.12
09	No job security	132	8.98
10	Lack of recreation facilities	66	4.49
11	Lack of health education and family planning concepts	48	3.27
12	Absence of life insurance	130	8.84
	<b>Total</b>	<b>1470</b>	<b>100.0</b>

Source: Questionnaire survey, \* Multiple answers are considered

**Table 8. List of selected variables as the parameters for correlation coefficient**

SL No	Factors of variables	Parameters of variables
01	Socioeconomic parameters	Gender
		Age
		Education
		Occupation
		Monthly income
		Duration of living
		Residential status
		Living place
02	Impact parameters	Health impacts
		Economic impacts
		Political impacts
		Employment related impacts
		Business related impacts
		Environmental pollution impacts

Source: Field survey

**(i) Relationship between ship breaking activities and socioeconomic parameters of the respondents:**

Coefficient of correlation was computed in order to explore the relationship between ship breaking activities and socioeconomic parameters of the respondents. The socioeconomic parameters of the respondents are considered as the independent variables and ship breaking activities are considered as the dependent variable to compute the correlation matrix. The summary findings of correlation coefficients between ship breaking activities and socioeconomic parameters of the respondents are shown in the following Table 9.

It is observed from the above Table 9 that the calculated values of the correlation coefficient 'r' regarding the education (0.413), occupation (0.457), Monthly income (0.368), duration of living (0.391), residential status (0.211) and living place of the respondents (0.371) respectively found which are almost higher than the tabulated value against same parameters followed by 0.188 and 0.250 at 5% and 1% level of significance in the context of study area. The findings indicated that the calculated values are higher than the tabulated values. So, the relationships between the above independent and dependent variables are almost significant. On the other hand, the observed

**Table 9. The values of correlation coefficient between the ship breaking activities and socioeconomic parameters**

Dependent Variable	Independent Variables	Computed value of 'r'	Tabulated value of 'r' at 84 degrees of freedom	
			at 5% level	at 1% level
Ship breaking activities	Gender	0.117 <sup>NS</sup>	0.188	0.250
	Age	0.093 <sup>NS</sup>		
	Education	0.413**		
	Occupation	0.457**		
	Monthly income	0.368**		
	Duration of living	0.391**		
	Residential status	0.211*		
	Living place	0.371**		

Source: Field Survey

(Notes: <sup>NS</sup> = Not significant, \* = Significant at 0.05 level of probability, \*\* = significant at 0.01 level of probability with one tailed and 'r' = Pearson's Correlation Index)

**Table 10. The values of correlation coefficient between ship breaking activities and its impact parameters**

Independent Variable	Dependent Variables	Computed value of 'r'	Tabulated value of 'r' at 60 degrees of freedom	
			at 5% level	at 1% level
Ship breaking activities	Health impacts <sup>1</sup>	0.388**	0.211	0.295
	Economic impacts <sup>2</sup>	0.435**		
	Political impacts <sup>3</sup>	0.478**		
	Employment related impacts <sup>4</sup>	0.298**		
	Business related impacts <sup>5</sup>	0.317**		
	Environmental pollution impacts <sup>6</sup>	0.314**		

Source: Field survey (Where; \* = Significant at 0.05 level of probability, \*\* = significant at 0.01 level of probability with one tailed and 'r' = Pearson's Correlation Index)

values of two variables *ie.* Age and Sex of the respondents are found (0.093) and (0.117) which is lower than the tabulated values (Table 9). So, these two variables had no significant relation in the context of the study.

The above findings also demonstrated that a positive significant relationship is persistent between the ship breaking activities and socio economic parameters *ie.* education, occupation, monthly income, duration of living, residential status and living places of the respondents in the study area.

**(ii) Relationship between ship breaking activities and its impact parameters:** Coefficient of correlation was computed in order to explore the relationship between ship breaking activities and its impact parameters in the study area. The ship breaking activities are considered as the independent variables and impact parameters are considered as the dependent variables to compute the correlation matrix. The summary findings of correlation

coefficients between ship breaking activities and its impact parameters are shown in the following Table 10.

**Notes**

1. Health impacts are considered as the various health risks and diseases by the ship breaking activities among the workers and victims in the study

2. Economic impacts are considered as; various economic activities, economic transactions, personal income and loss –benefit by this activity.

3. Political impacts are considered as ; Political threat and panic, threat of local powerful man, threat of local powerful men and threat from land robbery.

4. Employment related impacts are considered as; employment opportunity increased or decreased in the study area.

5. Business impacts are considered as; Marketing of breaking materials, shopping business and shipping materials oriented retail and whole sale business in the study area.

6. Environmental pollution impacts are considered as; Air, Water, Soil and Noise pollution, Loss of Biodiversity, Chemical contamination in the study area.

7. It is observed from the above Table 10 that the calculated values of the correlation coefficient 'r' regarding the Health impacts (0.388), Economic impacts (0.435), Political impacts (0.478), Employment related impacts (0.298), Business related impacts (0.317) and Environmental pollution impacts (0.314) respectively found which are almost higher than the tabulated value against same parameters followed by 0.211 and 0.295 at 5% and 1% level of significance in the context of study area. The findings indicated that the calculated values are higher than the tabulated values. So, the relationships between the above independent and dependent variables are almost significant. The above findings also demonstrated that a positive significant relationship is persistent between the ship breaking activities and its impact parameters *ie* Health impacts, Economic impacts, Political impacts, Employment related impacts, Business related impacts and Environmental pollution impacts in the study area.

## 6. Recommendations for sustainable practices of ship breaking activities

Considering the positive role of ship breaking in national economy ship breaking can not be stopped. Recently, the Prime minister of the Government republic of Bangladesh has declared and it as the industry. So, a sustainable approach should be taken to minimize the negative consequences and impacts of ship breaking activities in our coastal zone. The following steps should be taken for sustainable practice of ship breaking activities in Sitakunda ship breaking industrial area in the context of Bangladesh.

- Government should be included 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.

- 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.

- 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.

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

- 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. 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.

- 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. Ship breaking activities should be carried out in a planned and hygienic way. A layout should be designed before starting to break the ship.

- 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 labor rights and particularly, freedom of association and the right to collective bargaining, just and favourable conditions of work (minimum salary, overtime payment, salary deductions, working hours, holidays and benefits, weekly rest etc.) should be ensured.

- Ship breakers or owners should provide PPE (personal protective equipment) in general and appropriate PPE in specialized cases for workers and labors. Owner and contractors have to take the responsibility in providing compensation, treatment and security for the labors. Adequate compensation for victims of accident and their families, social security etc. should be ensured.

- Ships are allowed to import for breaking except war ships, ships used in the Naval, ships operated by atomic power, ships used to carry radioactive materials, the ships containing huge toxic hazardous materials. It should be ensured that the ship will be dismantled in an environmentally sound manner and the environment will not be effected harmfully.

## CONCLUSION

The ship breaking activities is treated as a profitable business activity with an important source of raw materials of scrap iron and steel industries in Bangladesh. Recently, it is declared as an industry but still there is no separate guideline or rules for ship breaking activities in Bangladesh. As a result, there are often occurred accidents, lost of valuable lives and serious violation of laborers rights. On the other hand, ship breaking activities impacts on biodiversity and environment which are matter of exploration. All the workers done their works 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 is no good arrangement for pure drinking water, healthy food, hygienic toilet and living place for workers. The present study also revealed that the entire scrapping process remains manual where worker's safety is jeopardized by a near-total absence of precautions and planning. Usually, these workers carry weights far above the limit prescribed in the industrial Act and 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; 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. 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. 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. 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 proper authority in the study area. The ship breaking plan should ensure the occupational safety and health protection for the workers so that the death and injury by accidents, work place related diseases would be reduced in a minimum level.

It is observed from the study that it has huge negative impacts on coastal fishermen and workers of the ship yards. The ship breaking activities contaminate the coastal soil and sea water environment and thus impair ecological siftings. The problem mainly associated 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.

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. There is no government body which especially deals with the ship breaking activities; instead the issue is deal with by the

concerned ministry in Bangladesh. There is no enforcement of the Labor Laws, no legal binding framework in international commitments, no environmental standard set for the industry, no institutional arrangement for monitoring of the ship breaking activities. There is no consolidated policy or strategy or guideline in Bangladesh for ship dismantling and there is also a serious lack of communication between the responsible Ministries. So, need a sustainable and eco-friendly policy for the ship breaking activities in Bangladesh.

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## REFERENCES

- Banglapedia (2008). The National Encyclopedia of Bangladesh, 2<sup>nd</sup> edn, Asiatic Society of Bangladesh, Dhaka, Vol. II, Pp: 431.
- FIDH (2002). 'Where do the 'floating dustbins' end up? Labor rights in ship breaking yards in South Asia: The cases of Chittagong (Bangladesh) and Alang (India), An investigative mission report by FIDH (International Federation for Human Rights), Paris, France, Pp: 111-12.
- Hossain MM, Islam MM (2006). Ship Breaking Activities and its Impact on the Coastal Zone of Chittagong, Bangladesh: Towards Sustainable Management, 1<sup>st</sup> edn, Young Power in Social Action (YPSA), Chittagong, Bangladesh.
- Islam MN (2011). An Introduction to Research Methods, 2<sup>nd</sup> edn, Mullick and Brothers, Dhaka, Pp: 127-128.
- Karim R (2010). 'Sustainability views of Adaptation measures to the potential impacts due to climate change in the Coastal zone of Bangladesh', MS Thesis, Industrial Ecology Department, Royal Institute of Technology, Stockholm, Sweden.
- OSHA (2001). 'Ship Breaking Fact Sheet. U.S. Department of Labor,' Report by OSHA (Occupational Safety and Health Administration), Pp: 86.
- Online <http://www.osha.gov>. Accessed on 12 may, 2012.
- Salim M (2009). 'Livelihood Conditions and Health Hazard Risks of Workers in the Ship Breaking Industry: A Case Study on Sitakunda Ship Breaking Industrial Area, Chittagong', MS Research Project, Department of Geography and Environmental Studies, University of Chittagong, Bangladesh.
- Singh S (2001). 'Domestically prohibited goods, trade in toxic waste and technology transfer: issues and developments'. A seminar paper was presented at Centre for International Trade, Economics & Environment, (CUTS) held on 23<sup>rd</sup> May at Jaipur, India, Pp: 7-8.