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Abstract

Ship breaking is the process of dismantling an obsolete vessel?s structure for scrapping or disposal conducted at a beach, recycling the ship?s structure. It is a challenging process, due to the structural complexity of the ships and the involvement of many environmental, safety, and health issues. Six hundred end-of-life ships are broken annually without cleaning by the owner prior to export, and only a very few cleaned before scrapping. More than 3,000 ships with the toxic wastes have been exported over the last five years to Asian ship breaking yards and Bangladesh is the leading ship breaking country is south Asia. Although the steel is recycled, the toxic substances such as PCBs, metals, asbestos, lead, waste oil, TBT, etc enter into the environment and into the bodies of the workers. A new EU report on the phasing out and scrapping of single hull oil tankers concluded that 2,200 oil tankers would have to be scrapped after the end of their commercial life by the year 2012.Bangladesh is dependent on ship scrapping for fulfilling its domestic demands for steel and iron. Ship scrapping is not regulated by environmental law, nor is there care for the health and safety of the workers. Workers of Bangladesh break up European vessels with no protection from explosions, asbestos or a cocktail of toxic chemicals contained in the ship. Over the last 20 years more than 400 workers have been killed and about 6000 were seriously injured that indicates the highest accidents and casualties at the yards in the region. Workers cut down steel plates continuously without uniforms, protective gloves, boots and goggles. The Main objective of this paper is to Identifying hazards associated with ship breaking, to Calculate risk level according to those hazards and recommendation to ensure safety for the ship breaking workers.

Index terms— risk, hazard, ship breaking industry, risk calculator, OSH (occupational safety and health), OSHA.

1 Safety Management for Bangladeshi Ship

Breaking Industries Perspective Ripon Kumar Saha ? , Md. Saiful Islam ? & Md. Mahbubur Rahman ? Abstract Ship breaking is the process of dismantling an obsolete vessel's structure for scrapping or disposal conducted at a beach, recycling the ship's structure. It is a challenging process, due to the structural complexity of the ships and the involvement of many environmental, safety, and health issues.

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yards in the region. Workers cut down steel plates continuously without uniforms, protective gloves, boots and goggles. The Main objective of this paper is to Identifying hazards associated with ship breaking, to Calculate risk level according to those hazards and recommendation to ensure safety for the ship breaking workers.

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here have been thousands of cases of death and injury at the Chittagong yards. Over the last twenty years more than 400 workers have been killed and 6,000 seriously injured, according to the estimates made by several NGOs and the Bangladeshi media. The explosion of the Iranian tanker TT Dena on 31May 2000 alone is said to have caused fifty deaths. To this toll must be added thousands of cases of irreversible disease which have occurred and will occur in future due to the Authors ? ? ?: Undergraduate Student, Department of Industrial Engineering & Management (IEM), Khulna University of Engineering & Technology (KUET), Khulna-9203, Bangladesh. e-mails: ripon_kuet27@yahoo.com, saifuliem@gmail.com, mahbub.iem@gmail.com toxic materials that are handled and inhaled without minimum precautions or protective gear. The recent 279 th Session of the ILO's Governing Body (November 2000) endorsed a conclusion of the Tripartite Meeting on the Social and Labor Impact of Globalization in Manufacture of Transport Equipment (May 2000), stating that, as a first step, the ILO should draw up a compendium of best practice adapted to local conditions leading to the preparation of a comprehensive code on occupational safety and health in ship-breaking, 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, and requested the Director-General to bear this in mind when drawing up proposals for the future work of the Office. The draft Program and Budget for 2002-03 also identifies the improvement of working conditions at Asian ship-breaking sites as a priority area for extra-budgetary activities.

The OSH policy for the ship breaking facility should include, as a minimum, the following key principles and objectives to which the facility is committed: A hazard analysis is one of the most important elements of the safety management program. A hazard analysis is an organized & systematic effort to identify the significant of potential hazard in workplace. This analysis provides information that will help the employers & employees in making decisions for improving safety & reducing the consequences of unwanted & unplanned hazardous situations. The hazard analysis should focus on equipments instrumentations utilities human actions & external sectors that may impact the process. These considerations assist in determining the hazards and potential failure points or failure modes in a process. We have also identified risk level of different work activity which is done in ship breaking yards using risk calculator. We have categorized risk into high risk, moderate risk & low risk. Now we will be able to calculate risk for different hazardous events. Here E1 occur frequently, E2 occur less than E1, E3 occur less than E2. So E1>E2>E3.

2 Proces s Identifica

3 b) Risk Calculation

Using the data of hazard identifications we shall calculate risk now. Here we have divided risk into three categories. These are: a) High risk: This indicates that the level of risk is unacceptable.

b) Moderate risk: This indicates that the level of risk should be reduced to a level as low as reasonably practicable (ALARP). c) Low risk: This indicates that the level of risk is broadly acceptable.

In this risk calculator probability level divided into six categories. These are:? Frequent ? Probable ? Occasional ? Remote ? Improbable ? Extremely Remote

In risk calculator consequences are divided into six categories. These are:? Multiple fatalities ? Fatalities ? Sever ? Major Global Journal of Researches in Engineering XIII Issue v v v V Version I Year 2013 Volume (D D D D) G ? Minor ? Significant d) Risk Calculation Diagram

With this diagram we shall calculate risk for event group E1, E2, E3. Here the calculation is given below: Escape routes should be frequently inspected and continuously modified on the ship according to the breaking progress. d) Roadways, quays, yards, etc., where persons or vehicles move or are stationed should be so constructed and maintained as to be safe for the traffic that they have to carry. e) A suitable housekeeping program should be established and continuously implemented on each ship breaking facility. f) All openings through which workers are liable to fall should be kept effectively covered or fenced and clearly indicated in the most appropriate manner.

g) Adequate precautions should be taken, such as the provision of fencing, lookouts or barriers to protect any person who might be injured by the fall of materials, or tools or equipment being raised or lowered. h) Fire Prevention and Fire-Fighting measures should be taken by the employer to ensure safety for ship breaking workers. i) Signs and symbols are a very effective method for warning against hazards and for presenting information in a non-linguistic form. Safety signs and notices should conform in shape and color to the requirements of the competent authority. j) Visitors should not be allowed access to ship breaking facilities or ships, as appropriate, unless accompanied by or authorized by a competent person and provided with the appropriate protective equipment. k) As a basis for eliminating or controlling exposure to hazardous substances (including dusts, fumes and gases), the provisions of the ILO code of practice ambient factors in the workplace should be consulted.

From our research work we have come to know that ship breaking is a very much dangerous process. A lot of unwanted death has been occurred from 2001 to 2012 due to ship breaking, many workers also get injured. This types of accidents happened because there are no safety rules for ship breaking workers. Worker do works

without appropriate safety equipments so they easily expose to hazardous element. It increases the probability of accidents. So if we want to reduce the rate of accident we have to think about the safety issues of ship breaking worker. In our research work we have identified different hazardous work activities. We have also calculated the risk level of those work activities. With the help of the risk level we have given recommendations for different types of dangerous work. If we can implement those recommendations totally or partially it is sure that accident rate will be reduced to a acceptable level. In our research work we have shown an important thing that is the zoning of ship breaking area. This is a good idea to divide the ship breaking area into different parts. If we can ensure safety to every zone then total ship breaking area will be a safe place for the workers. If we can improve safety we shall get higher efficiency from the workers, we shall be able to break ship within a short time, as a result we shall be able to earn more money, and moreover worker satisfactions will be achieved. At last it can be said that our government should come forward to ensure the safety for the ship breakers. G safety of their own ship breaking yards the workers will be benefited and the owners will be benefited as well. [1] [2] [3]

9

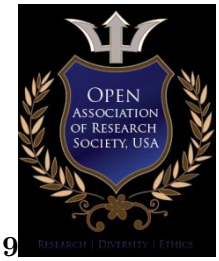

Figure 1: 9 ©

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Figure 2: Figure 1 :

Figure 3: ?

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Figure 4: Figure 2 :

Figure 5:

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No.	Activity	Cause	Consequence	Frequency of happening
01	Crushing in metal cutting machinery	Hand in running machine due to inattention, in appropriate protective equipment	Finger or hand injury	1 in 10
02	Crushing in material pulling machinery	Sleepy floor, in appropriate protective equipment	Finger or hand injury	1 in10
	Being caught inside	Missing cover inattention	Significant body injury	1 in 1000
03	broken ship			
04	Fall from above	Inattention	Leg or hand injury	1 to 100
	Damage from	Rupture during operations	Major wounds	1 in10
05	machinery splinter			
06	Knock from edge, metal part etc	Inattention	cuts	1 in 10
07	Hair or cloths being caught in equipment	Inattention, inappropriate protective Cause	Significant body injury	1 in 1000
08	Bodily damaged from unobserved machinery start-up	Technical failure, Noise, inappropriate protective equipment	Significant body injury	1 in 100
09	Crushing when lifting material	Sleepy floor, inattention	Finger or hand injury	1 in 10
	Damage due to roll	Rupture of spindle, carelessness	Sever injuries, fatalities	1 in 100
10	coming loose			
	Damage due to	Failure of tackle, inappropriate fastening	Sever injuries, fatalities	1 in 10
11	dropping material			
12	Fire	Dust oil, smoking, sparks	Loss of machine, destruction of machines, injury to human body	1 in 10

From the table we have shown that event 01, 02, 05, 06,09,11,12 are occurred minimum 1 time among 10 incidents. Event 04, 08, 10 are occurred minimum 1 time among 100 incidents. Event 03, 07 are occurred minimum 1 time among 1000 incidents.
Those events are grouped together and named E1, E2, and E3 in the table below:

Frequency of occurring	Event No.	Name
1 in 10	01,02,05,06,09,11,12	E1

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ATSDR (Agency for Toxic Substances and Disease Registry).1998. The nature and extent of lead poisoning in children in the United States: A report to Congress, July 1988.

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