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An Insight into Ship Recycling: Facts and Figures

Metin Taylan

*Istanbul Technical University, Naval Architecture and Ocean Engineering Faculty,
34469 Maslak Istanbul, Turkey, Email: taylan@itu.edu.tr.*

Abstract

Ship recycling is an important sector which interests many engineering disciplines such as naval architecture, environmental, metallurgical etc. Ship recycling, on the other hand, raises a lot of concerns since it is directly related to human safety and health and environmental pollution. There have been strict rules and regulations issued by the international authorities such as IMO, ILO and the others. This paper deals with the current status of ship recycling in Turkey and all over the world in terms of statistics, rules and regulations, immediate and long term impact on the environment and shipbuilding industry. An elaborate statistical analysis has been carried out by considering various aspects. A comparative study which would offer valuable information to ship-builders, environmental agencies, national and international authorities was also undertaken.

JEL Classification: J8; L5; Q2.

Keywords: Ship recycling; Scrap metal; Hong-Kong Convention; Asbestos.

1. Introduction

In simple terms, shipbreaking is the practice of dismantling an obsolete vessel for scrapping and/or disposal. At the end of their economic lives, ships are bound to their final destination namely, scrapping (or recycling). Mainly, the procedure is carried out at a pier, dry-dock, beach or dismantling slip, including a wide range of undertakings such as removing all equipment and furnishings, cutting and recycling the ship's hull etc. Ships are very complex structures consist of a range of material types, and their breaking procedure is equally tedious, cumbersome and dangerous since it mostly relies on human power and labor (Stuer-Lauridsen, F., *et al.*, 2007).

Shipbreaking poses a great degree of risk to human health and environment. It involves a great deal of hazardous exposures to asbestos, lead etc. and hazardous work activities including bilge and ballast removal and tank cleaning. It is therefore raised a lot of environmental pollution and health concerns and hence entailed legislative measures by the relevant bodies such as IMO, ILO etc. Disposal of hazardous and non-hazardous waste safely entails a viable and sound waste management system.

Approximately, 400 large ships are dismantled every year in the world. Most of these shipbreaking take place in India, China, Bangladesh and Pakistan under improper conditions in terms of workers' health and environmental protection. Especially in Bangladesh, the ratio of shipbreaking related accidents and acquisition of chronic and deadly diseases are relatively high. Furthermore, the proximity of the environment is severely polluted by hazardous material from dismantled ships. The "beaching" method is mostly used in the above-mentioned South Asian countries.

Turkey has also been involved in controlled shipbreaking activities in Aliğa, Izmir since 1976. Although Turkey's shipbreaking capacity is relatively small with compared to the leading nations, it offers a good geographical alternative to European countries within the region. Adoption of Hong-Kong Convention and amendment to Basel Convention Leded Turkey towards legislating the national shipbreaking regulation in the direction of green shipbreaking.

2. International Rules and Regulations

IMO has been involved in ship recycling comprehensively. IMO's intervention in the recycling of ships was first brought into consideration at the 44th MEPC session in March 2000. An extensive research was carried out on the matter and guidelines were developed by the Marine Environment Protection Committee (MEPC) and finalized at the MEPC 49th session in 2003. Finally, these guidelines were adopted as Guidelines on Ship Recycling by resolution A.962(23) and were later amended by resolution A.980(24) (Mikelis, 2009).

Resolution A.962(23) IMO Guidelines on Ship Recycling give advice to all interested parties in the recycling process, including administrations of ship building and maritime equipment supplying countries, flag, port and recycling states, as well as intergovernmental organizations and commercial bodies such as ship-owners, ship builders and repairers and recycling yards (Mikelis, 2006-2009).

The Hong Kong Convention, which was adopted in 2009 by 63 delegates, aims to address all the matters about ship recycling. The ships sold for scrapping most of the time contain environmentally hazardous substances such as asbestos, heavy metals, hydrocarbons and others. It also addresses concerns raised about the working and environmental conditions at many of the world's ship recycling yards (Mikelis, 2007) and (Dimakopoulos, 2005).

The Hong Kong Convention deals with the design, construction, operation and preparation of ships in order to facilitate safe and environmentally sound recycling considering the safety and operational efficiency of ships. Furthermore, it ensures the operation of ship recycling facilities in a safe and environmentally sound manner. It also stresses the establishment of an appropriate enforcement mechanism for ship recycling, incorporating certification and reporting requirements.

Finally, in regard to the above-mentioned current convention, the legislative side of the issue has been examined whether the current regulations were in compliance with the opinions of the all the parties involved.

3. Ship Recycling in Turkey

Turkish ship recycling sector is located at Aliğa, Izmir on the Aegean sea coast, West of Turkey and has been operated at the site since 1976. The site stretches approximately 1300 m. along the coastline occupying an area of 600,000 m². There are 21 shipbreaking yards operating in the region. The annual capacity of the breaking yards is about 900 000 LTD and the largest size of a ship that can be accepted is 50 000 LTD. In terms of man power, about 2000 workers may be employed at full capacity, whereas 1200 workers on the average were employed in 2011. The location of the breaking yards is shown in Figure 1, Figure 2 and Figure 3 (Maritime Transportation Statistics, 2010-2011 and Vardar, 2009).

Figure 1. Aliğa ship recycling region in Izmir



Figure 2. Plan of Aliğa ship recycling shipyards

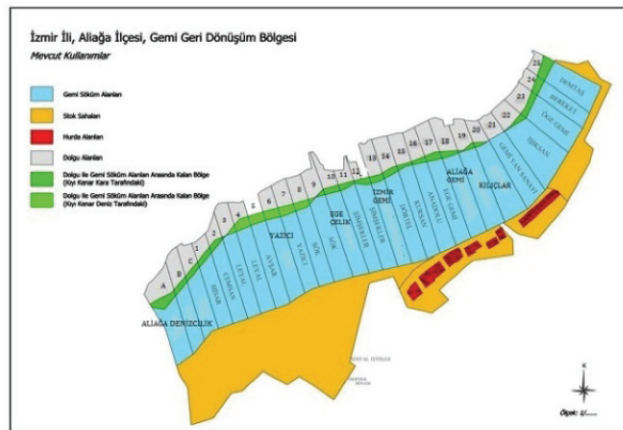


Figure 3. Location of Aliğa



According to 2010 statistics, Turkey is in the fifth place in shipbreaking tonnage in the world with approximately 3.5%, Figure 4. The volume of ship recycling has increased notably in the last few years in Turkey. The following graphs show the capacity of ship-breaking over the years in terms of tonnage and quantity.

Figure 4. Recycled Gross tonnage distribution in the world (2010)

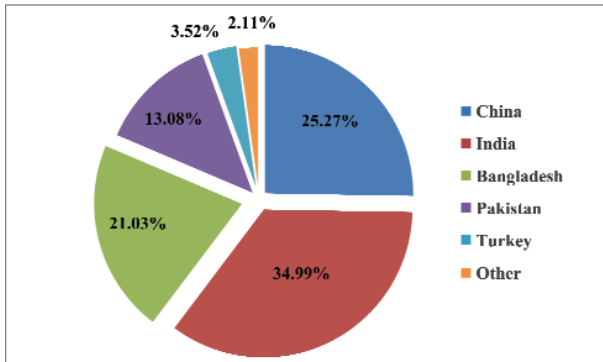


Figure 5. Number of recycled ships over the years

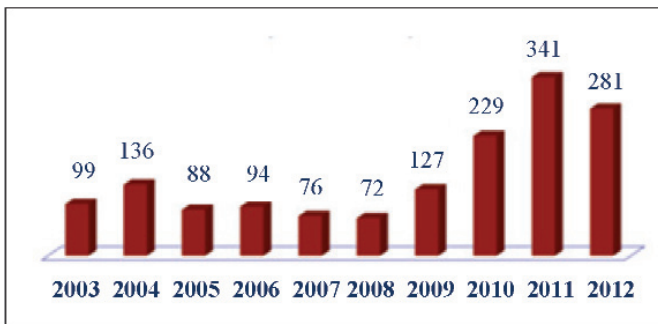
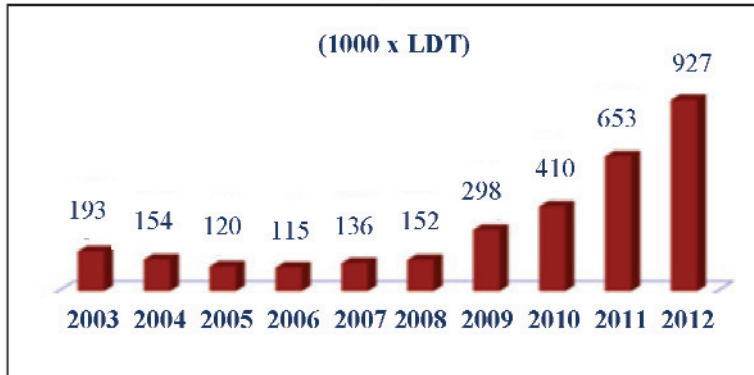
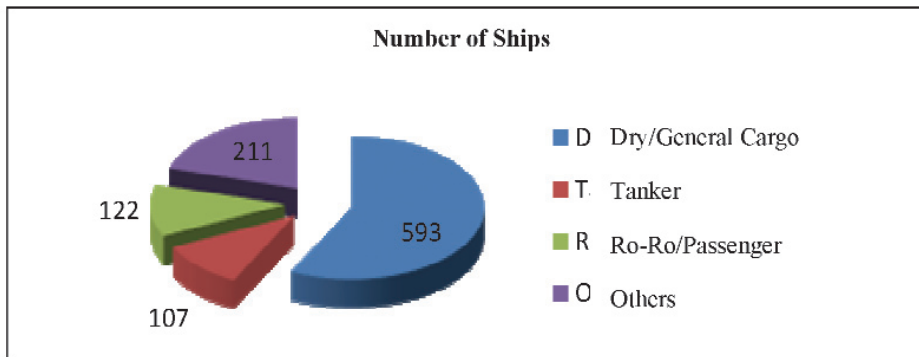


Figure 6. LTD of recycled ships over the years



As it is seen from the graphs (Figures 5 and 6), there has been a significant increase in ship breaking starting from the year 2008 in Turkey. Figure 7 depicts recycled ship types during past 5 years. More than half of the dismantled ships are general cargo vessels.

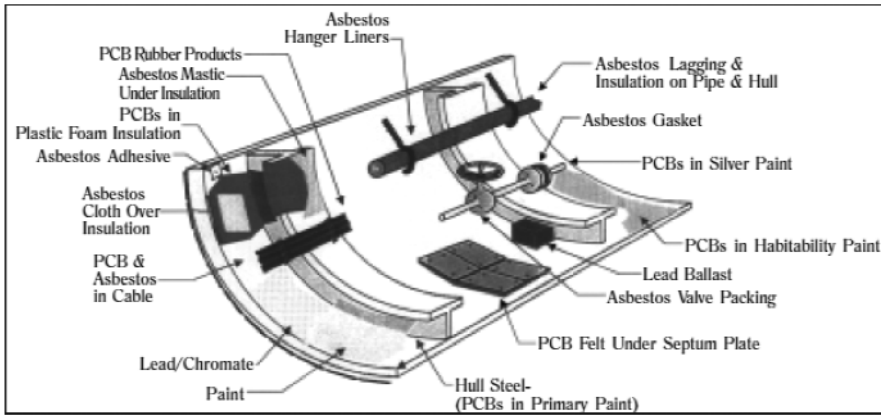
Figure 7. Number of recycled ships by type (2008-2012)



4. Waste Cycle and Management

Ships are made of using so many different material groups such as metals, plastics, wood, textiles and other hazardous items. Figure 8 shows these material types and their typical locations in a ship (Mikelis, 2006).

Figure 8. Possible locations of hazardous materials in a ship (OSHA, 2001)



When a ship is dismantled, various materials and/or waste are collected. Recyclable materials may be obtained from ships are classified as shown in Table 1.

Table 1. Type of waste from ships

Material Type	Destination
Metals (ferrous/non-ferrous)	Recycle
Non-hazardous waste	Municipal landfill
Chemicals and paints	Energy generation
Bunker/Oils/Slops	Energy generation
Electronics and batteries	Recycle
Asbestos and toxic waste	Industrial landfill
Equipment	Re-use/sale

During the last decade, significant improvements have been made at the ship recycling yards in Turkey. A new National Regulation on Shipbreaking; a certification system for the yards; the installation of cement flooring, drainage systems and oil booms; and the establishment of a Waste Management Center and asbestos removal procedures are the main constituents of the enhancement action (Stuer-Lauridsen, F., *et al.*, 2007).

In Figure 9, waste management facilities are shown in the map and in Table 2, amount of waste and its breakdown are tabulated in 2007.

Figure 9. Waste management locations (Vardar, 2009)

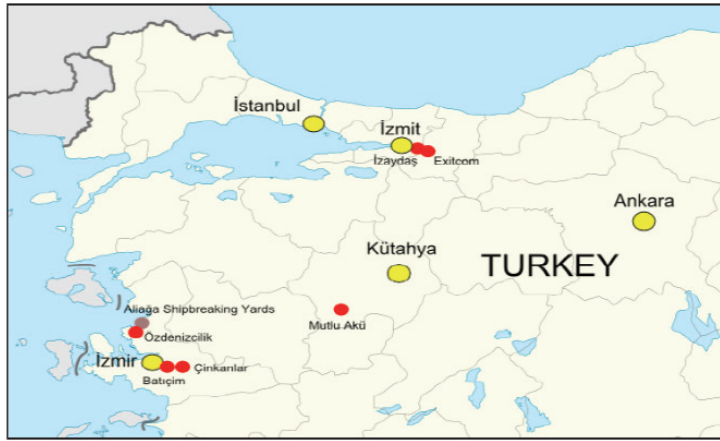


Table 2. Amount of waste in 2007 (Vardar, 2009)

Type of waste	Recycling / disposal facility	Amount of waste (tons)
Waste cable	AkKablo	127.61
Asbestos	Izaydaş	187.32
Waste oil	Çınkanlar	967.54
Bilge water	MuglaÇimento	8.25
Bilge water	BatiÇim	11.44
Medical waste	Izaydaş	1322 pieces
Waste batteries	Mutlu	2.14
Waste batteries	AslanAvcı	6.58

Turkey seems an appropriate country for shipbreaking especially for the European countries. Turkey complies with the statement and principles of the Basel Convention. Constant pressure and demands from the environmental and labor groups such as Greenpeace and the trade union for speedy enhancements at Turkish shipbreaking yards, the final version of the Shipbreaking Regulation was adopted in 2004.

5. Sample Works and Financial Matters

In this section, a ship dismantled in a breaking yard in Turkey is given as an example. RFA Oakleaf (A111) was a 30 years old, single hull 11000 tons Leaf-class fleet support tanker, which ceased active service with UK MOD in June 2007, (UK Ministry of Defense, 2011).

Due to new rules by MARPOL in 2010 destined the ship for breaking. The ship was towed to LEYAL Ship Recycling Ltd based in Aliğa, Turkey. The tanker had been com-

pletely dismantled in about 4 months since it arrived at the breaking yard. Over 97% of the materials were recycled and recovered from the tanker. The general particulars of the tanker were as follows;

- Lightweight 10400 tons
- Length $L_{OA} = 173.69$ m
- Breadth $B = 32.23$ m

The estimated metal weight was 8000 tons including machinery, and estimated metal type was 90% mild steel. The following has been obtained after dismantling;

Table 3. Amount of waste/material from Oakleaf (UK Ministry of Defense, 2011)

Waste/Material type	Amount (tons)	Destination
Ferrous	8915	Recycled
Non-ferrous	88	Recycled
Asbestos	1.3	Industrial landfill
Other regular waste	199	Landfill
Equipment	126	Re-use/Sale
TOTAL	9329.3	

Table 4. Amount of waste/material from Oakleaf (UK Ministry of Defense, 2011)

Final Destination	Amount (tons)	Percentage (%)
Re-use/Sale	126	1
Recycling	9003	97
Industrial landfill/Landfill	200.3	2
TOTAL	9329.3	

Financial side of shipbreaking is governed by market dynamics such as freight rates, steel scrap prices etc. These are the factors which are very important whether or not a ship will be dismantled. The cost of ship recycling depends on labor cost and the costs of shipbreaking yard facilities. Therefore, the ship owner chooses a breaking yard based on the price offered for the metal which in turn depends on the demand for scrap steel and on the costs of the breaking process (Milieu Ltd. & COWI, 2009).

The price of scrap steel in USD per light displacement ton (LDT) is approximately equal to the steel weight of the ship. Scrap steel prices are so volatile in the world and governed by supply and demand rules. Over the years the price has been around 150 \$/LDT.

However, the strong demand for steel scrap in China raised the prices up to 700 \$/LDT during 2005-2008. The current market price of steel scrap is around 250 \$/LDT.

6. Job Related Accidents and Health Issues

According to the 2010 statistics based on a survey carried out with 256 recycling workers, the average age of the workers employed in the ship recycling sector is 35. Average working hours of the workers is 8 hours a day on a 6 days a week basis. Amongst the reported chronic diseases; ulcer (14%), spinal disorders (14%) and asthma (14%) are the most prominent ones. In terms of job satisfaction; 11% confirmed that they are highly satisfied, 71% satisfied and only 2% claimed they are not satisfied at all. 64% of the workers claimed that they received job related training before they start work, whereas 69% had first-aid training.

Frequency of job related accident figures are 5100 out of 100.000 over the past year period and 800 incidents out of 100.000 is the number showing the worker who had two or more accidents in a year. The above figures reveal a relatively low prevalence of job related accidents which may be attributed to training and accident awareness.

7. Conclusions

In this paper, the facts, difficulties and problems encountered in shipbreaking industry have been outlined. Due to its intrinsic nature and associated environmental concerns, there are only a few countries in the world which are engaged in shipbreaking sector. Turkey is also among these shipbreaking countries in a relatively small scale. The government has confined the activities of the sector to only Aliğa, Izmir at which tidal and other environmental effects that may contribute to environmental pollution from shipbreaking are neglected.

Approximately 25% of commercial ships in the world have EU Member States' flag and around 40% of the ship tonnage is owned by European companies. Since the annual scrap volume is approximately 4 million LDT, the amount of scrap from EU fleet amounts to about 1.6 million LDT per year until 2020. It is expected that capacity of ship recycling will rise owing to the phasing out of all single-hull oil tankers.

Despite all national and international rules and regulations, shipbreaking is still one of the most difficult and hazardous procedure by all means. The Hong Kong International Convention on the Safe and Environmentally Sound Recycling of Ships (Ship Recycling Convention), adopted on May 2009 is expected to enter into force in 2015. There are some concerns that the convention is likely to become fully effective even much later than 2015. Thus, some interim measures are imperative until the early implementation of the convention becomes effective.

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