June 2016
Thematic Issue 55

Ship Recycling: Reducing Human and Environmental Impacts

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Contact:
guedess@mar.ist.utl.pt

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1.http://ec.europa.eu/environment/waste/ships/pdf/com_2007_269_en.pdf

2.http://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX:32013R1257

3.MARSTRUCT (Network of excellence in marine structures) was supported by the European Commission under the Sixth Framework Programme. See: http://www.mar.ist.utl.pt/Marstruct/index.aspx

European Commission

Science for Environment Policy

Constituent materials more important than weight or class for environmental impact of shipbreaking, but valuation methods differ greatly

When broken down, ships can release hazardous substances into the environment. This study investigated the environmental impact of shipbreaking in one of Europe's few ship recycling yards, based in Portugal. The results reveal large differences between assessment methods and show that environmental impact depends on composition rather than size or class.

Although all shipbreaking sites have an environmental impact, these issues are more commonplace in south Asia, in countries such as Bangladesh, Pakistan and India which host the majority of the global industry. Europe makes a relatively small contribution to shipbreaking, dismantling just 3% of ships globally (by weight). In the OECD, there are registered shipbreakers in, for example, Italy, Spain, Turkey and the UK.

There are similar concerns throughout the global industry. A European Commission green paper 'On better ship dismantling'[1] revealed that the industry produces millions of tonnes of materials of environmental concern, such as oil, paint and asbestos, and that radical industrial change is needed to lessen the high human and environmental costs as soon as possible. Following this paper, the Commission adopted a comprehensive regulation on ship recycling[2] to reduce the negative impacts associated with ships flying EU Member State flags.

This study focused on the Portuguese industry. Although Portugal has a small shipbreaking industry (accounting for just 0.1% of all companies related to maritime activities in 2001), it is diverse and dismantles many different types of ship. The researchers, who were part-funded by the European Commission[3], set out to determine the environmental impact of dismantling these different ships using data collected from an environmentally certified (according to norm NP EN ISO 14001:2004) dismantling yard in Lisbon.

The researchers collected information on the amount and type of materials removed from 23 different types of ship: 18 merchant vessels (including nine transportation ships, three fishing vessels and six auxiliary ships) and five military ships. The researchers assessed the proportions of seven groups of materials in each ship: ferrous materials (e.g. steel), non-ferrous metallic materials, glass, wood, dangerous solid substances, dangerous liquid substances and 'undifferentiated' materials. For most ships, ferrous materials were the major constituents; however, wood accounted for 60% of the gross tonnage of the fishing vessels.

The researchers also assessed how many of the materials were recycled, as opposed to being re-used or sent to landfill. They found at least 85% of the materials removed from merchant vessels were recycled. The proportion of recycled materials was lower for military ships, but it was still the most significant final destination for materials.

Using this data, the researchers modelled the environmental impact for the different ships and under four scenarios: dismantling of the ship (the current, 'real world' scenario), total recycling of the ship (a fictitious scenario, in which all materials are recycled), ship abandonment, and ship sinking. They used the life cycle assessment tool SimaPro to conduct the analysis, alongside four different environmental impact assessment methods.

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(continued)

The researchers deemed that two of the four assessment methods used were sufficient to assess environmental impact. The first approach, eco-indicator 99 (H), was developed by the Dutch Ministry of Infrastructure and the Environment and measures human health, ecosystem quality and resource impacts. The second, IMPACT 2002+, measures cumulative toxicological risk and ecosystem impacts associated with emissions. As well as the categories measured by eco-indicator 99 (H), it also estimates climate change impact.

Both methods reported environmental impact in units called points, specifically millipoints (mPt). 1 mPt represents the yearly environmental load of one average European inhabitant. These units allowed comparison between ships and methods.

There was a vast difference in the scale of the values calculated by the two methods; the environmental impacts calculated by eco-indicator 99 (H) were 1000 times higher than the IMPACT 2002+. The researchers suggest these could set upper and lower limits for environmental damage. They highlight that the methods are based on different assumptions and that they weigh various factors differently which makes a direct, quantitative comparison difficult. However, it is possible to compare the relative ranking of influencing factors. According to eco-indicator 99 (H), ecosystem quality impacts were the greatest for all ships, while for IMPACT 2002+, human health impacts were the largest (with the exception of some military ships, for which climate change impacts were the most significant).

Most importantly, although the two methods generated substantially different results and assessed different environmental issues, both showed that impact did not correlate with gross tonnage or class. Instead, the relative proportion and types of materials were more important. Of the different ship classes, merchant and military vessels were the worst performing; their maximum values of environmental impact were around twice that of the fishing and auxiliary vessels.

Comparison of the four scenarios showed that full recycling had similar environmental impacts to the dismantling (current) scenario. This is perhaps to be expected, given that around 60–100% of materials removed from ships are recycled already. Abandonment and sinking also had similar impacts, although these were higher than those generated by recycling and dismantling, confirming the environmental benefits of recycling.

Ship recycling has negative environmental impacts, whatever the methods used, but the impacts of ship dismantling are shown to be less than abandonment or sinking. The researchers assert that the valorisation of parts, via the re-use, recycling and treatment of the materials and equipment removed from ships, can mitigate the impact. They also note that the ship-dismantling scenario did not contribute to depletion of the ozone layer (as assessed by the IMPACT 2002+ method). Importantly, this research also shows that the weight of a ship or its class does not directly correlate with environmental impact. Instead, the types and relative amounts of constituent materials are more important.