



A study on evaluating the status of current occupational training in the ship recycling industry in Bangladesh

Sefer A. Gunbeyaz¹ · Rafet E. Kurt¹ · Raphael Baumler²

Received: 21 May 2018 / Accepted: 29 January 2019 / Published online: 12 February 2019
© The Author(s) 2019

Abstract

Essential to steel production in Bangladesh, the ship recycling industry has become a vital component of the country's economy. After four decades of growth, Bangladesh continues to compete with India to lead the international ship recycling industry. In the Chittagong area, the ship recycling sector, and related downstream activities, provides employment and resources to nearby communities. Despite its profitability and income generation, poor working practices and low environmental standards tarnish the image of the sector at national and international levels. Numerous accidents and fatalities in ship recycling processes highlight the lack of adequate Occupational Health and Safety (OHS) standards. Seasonal migrant workers, many of whom unfamiliar with industrial settings, represent the majority of workers in ship recycling yards. Recruited by subcontractors, most of the workers in Bangladesh lack sufficient hazard awareness and basic safety requirements necessary to work in a ship recycling yard. For these reasons, as identified by the Bangladesh High Court and subsequent national rules, training of workers must be addressed in yards in Bangladesh. In this study, associated with the IMO-NORAD SENSREC project, existing conditions, solely about workers' training, has been addressed, assessed, and compared in accordance with IMO's Hong Kong Convention and ILO requirements, where detailed recommendations were provided to enhance OHS training in the yards.

Keywords Ship recycling · Training · Gap analysis · Curriculum development

✉ Sefer A. Gunbeyaz
rafet.kurt@strath.ac.uk

¹ Department of Naval Architecture, Ocean and Marine Engineering, University of Strathclyde, Henry Dyer Building, 100 Montrose Street, Glasgow G4 0LZ, UK

² World Maritime University, Fiskehammsgatan 1, 211 18, PO Box 500, SE-201 24 Malmö, Sweden

1 Introduction

The ship recycling industry in Bangladesh had emerged as a result of a vessel grounding in 1964, together with further wreck removal requirements after the 1971 Pakistan war (FIDH et al. 2008). The industry was previously located in developed countries in the 1970s (Galley 2014). The migration of this ‘dirty and dangerous occupation’ (Bailey and Rai 1999) from the west to the Indian subcontinent is described by Frey as the result of world’s redistribution of activities about ‘unequal ecological exchange’ (Frey 2015) and labour competition (SAFEREC 2005).

Currently, more than 90% of the global ship recycling capacity is presided by five countries—India, Pakistan, Bangladesh, China, and Turkey, respective to sharehold percentage. Clarkson Research, in its 2017 database, depicts that Bangladesh has recently overtaken India and Pakistan and currently leads world ship recycling industry in LDT (NGO Ship Breaking Platform 2017); a result which transpired when Bangladesh, disregarding favourable geographical factors and weather conditions (Hossain and Islam 2006), was able to propose better prices to ship owners selling their ships for recycling in comparison to India and Pakistan (Galley, 2014).

This competitive advantage is a definitive result of low labour costs, limited infrastructures/investments/maintenance, and limited environmental constraints. Moreover, Bangladesh domestic steel manufacturers and ship recycling traders recover metals from local recycling yards, of which 50–60% of the recovered steel is re-used in re-rolling mills in Bangladesh (Ahammad and Sujauddin 2017), together with numerous other material and equipment, which are re-sold and/or re-used. Such practices reduce energy consumption and capital/operational costs required when preparing new steel products. Despite the absence of accurate data on the workforce employed in this industry, it is currently estimated that about 40,000 workers are employed in the yards, of which migrant workers represent about 84.5% of the global statistic (ILPI 2016; SENSREC 2016a). Despite important benefits for the country, ship recycling industry remains criticised for its deplorable working conditions and the contamination of nearby environment (NGO Ship Breaking Platform 2017; World Bank 2010). After evidence was provided during the ILO-SAFEREC project in 2005, an NGO group including FIDH, YPSA, and NGO Ship Breaking Platform investigated the circumstances and published a report regarding child labour in the ship recycling industry in Bangladesh (FIDH et al. 2008).

In March 2009, following several lawsuits initiated by national NGOs, such as the Bangladesh Environmental Lawyers Association in support by international partners, the Bangladesh High Court momentarily discontinued ship recycling activities, prompting the Government of Bangladesh to induce further regulations within the industry.

Passed in 2011, the ‘Ship Breaking and Recycling Rules’ (SBRR) (DOE 2011) in inspiration from the Hong Kong Convention intend to address OHS and environmental issues related to ship recycling activities. Despite national efforts, difficulties in implementation have affected the efficiency of 2011 SBRR, where, within a period of 4 years, an estimated 53 workers lost their lives, with a further 78 injured workers, as labour conditions remain a serious issue, in accordance with a report by a national newspaper (The Daily Star 2016). In this context, the Bangladesh High Court issued a contempt rule against government officials and shipbreakers for failing to implement 2011 SBRR (The Maritime Executive 2016). It is expected that the upcoming

implementation of the Bangladesh Ship Recycling Act, 2017 will expand and strengthen the existing rules by requiring compliance with Hong Kong Convention requirements.

Despite the ILO emphasis on training workers ‘[...] to ensure that they have fully understood the dangers and how to avoid them’ (Alli 2008), the current status of the OHS training in ship recycling in Bangladesh remains weak and often non-compliant with minimum requirements. Indeed, low level of awareness on hazards, limited or inadequate training (SENSREC 2015a) combined with short-term seasonal workers (FIDH et al. 2008; SAFEREC 2005; SENSREC 2015a), jeopardise the health, safety, and environment protection (Muhibbullah 2013). In its 2009 Verdict 6/4/11, the Bangladesh High Court concluded that adequate training must be provided to workers engaged in ship recycling yards, which prompted BSBA (Bangladesh Ship Breakers Association) to build a training facility:

A system of comprehensive training must be introduced to impart training to those who shall be employed for shipbreaking activities. An Institute will be set up for the training purposes by BSBA at their cost for training such persons. [...] No workers shall be allowed to be employed in the ship breaking yards without certificate showing completion of the course.

The main aim of this article is to analyse the current status, identifying the needs for training ship recycling yards in Bangladesh in order to comprehend the situation in relation to ship recycling, where relevant literature was systematically reviewed, scrutinising current training in Bangladesh (prior SENSREC WP4) in comparison to international norms and practices, identifying the need for the enhancement and development of training for workers.

2 Systematic analysis of the literature to identify the gap

In the state of the art, several studies had focused on Bangladesh, which were identified in the Scopus and Science Direct databases by means of the keywords ‘ship recycling/breaking/dismantling’ and ‘Bangladesh’, where the collected papers were analysed and classified in accordance with their area of interest to ascertain and undertake the gap in the literature.

The result of the review acknowledged that most of the research outputs had focussed on basic health and safety and environmental problems of the industry, while the rest focused on changes required in legislation and relevant social policy. This review accentuates the fact that a minimal number of studies have been focused on the training of the workers, despite this being vital in establishing a safe working environment (Arslan et al. 2013). Five studies were found to address training in the ship recycling industry. However, these studies either do not go beyond highlighting the importance of training, or they lack in-depth analysis which may be used as a roadmap by the stakeholders of the ship recycling sector. Results of this analysis are summarised in Table 1.

Furthermore, the following three projects were identified to have been carried out in dedication to the training of workers in Bangladesh: (1) SAFEREC project supported

Table 1 Studies identified in the literature

	Law & policy	Economic impact	Impact on health and safety	on Environmental impact and waste management	Current process	Training
Islam and Hossain (1986)				•		
Andersen et al. (2000)				•	•	
FIDH (2002)		•	•	•		
Khan and Khan (2003)			•	•		
Mashreque (2005)	•		•	•		
Hossain and Islam (2006)	•	•	•	•	•	
Amin and Billah (2007)				•		
Rousmaniere and Raj (2007)			•	•		
FIDH et al. (2008)	•		•			•
Hossain et al. (2008)			•			•
Karim (2009)	•		•			
Salim (2009)			•	•		
(Abdullah et al. 2010)			•	•		
Gregson et al. (2010)		•				
Hossain and Rahman (2010)		•	•	•		
Hossain et al. (2010)			•			
Sarraf et al. (2010)		•		•		
Courtice et al. (2011)			•			
Hossain (2011)		•	•	•	•	
Dhar et al. (2012)				•		
Khan et al. (2012)		•	•	•		
Pasha et al. (2012)		•	•	•		
Shameem (2012)	•	•			•	•
Siddiquee et al. (2012)				•		
Zakaria et al. (2012)		•	•	•		
Abdullah et al. (2013)				•		
Hasan et al. (2013b)				•		
(Hasan et al. 2013a)			•	•		

Table 1 (continued)

	Law & policy	Economic impact	Impact on health and safety	Environmental impact and waste management	Current Training process
Mohammad (2013)			•	•	
Muhibbullah (2013)			•		•
Aktaruzzaman et al. (2014)	•		•	•	
Alam and Faruque (2014)	•				
Jobaid et al. (2014)	•	•		•	
Fakhruddin et al. (2015)				•	
Frey (2015)	•	•	•	•	
Hossain (2015)		•	•	•	
Mizanur Rahman and Mayer (2015)		•			
Nøst et al. (2015)				•	
Sujauddin et al. (2015)					•
Haque (2016)			•		
Hossain et al. (2016)	•		•	•	
ILPI (2016)	•		•	•	•
Kibria et al. (2016)				•	
Rahman et al. (2016)		•	•	•	
Rahman and Mayer (2016)	•	•			
Ahammad and Sujauddin (2017)	•	•		•	
Kutub et al. (2017)		•	•	•	
Sujauddin et al. (2017)		•		•	

by the ILO, UNDP, and Bangladesh Ministry of Labour and Employment, in 2005; (2) BSBA Train-The-Trainer programme on hazardous waste management and oil pollution control (supported by the Netherlands, BSBA and creative in 2013); and (3) SENSREC 2015–2017 supported by NORAD (Norwegian Agency for Development Cooperation) and coordinated by the International Maritime Organization (IMO). The latter project consisted of a work package focusing on OHS (i.e. WP4 Part 1 and Part 2), where the overall programme was commissioned to assist the Bangladesh ship recycling industry on its road towards compliance with Hong Kong Convention requirements.

3 Materials and method

In this study, the current training materials and method in the industry have been reviewed, compared against international norms and regulations to identify the gaps, and a new curriculum has been prepared in order to address these gaps. As a first step, a field study was organised, which included several ship recycling yards, several government agencies, universities, and BSBA's training centre. Then, a comprehensive data collection study was conducted which includes OHS & Environmental Training in Bangladesh and International practice, assessment of workers, training records of the yards and training content, and training material of the BSBA. As a next step, the requirements of IMO and ILO on the training of workers were given to the expert group, who were asked to assess the BSBA training. The expert group consisted of two local experts on ship recycling and local laws, three experts on ship recycling and international laws, and an expert on environmental safety. The detailed information about the participants is given in Table 2.

It should be noted that, in this study, training evaluations were conducted based on paperwork and reported contents, rather than investigating the actual delivery of the training. This was deemed to be redundant as two preeminent local experts had been engaged in delivering and supporting BSBA training institute.

Three different assessment types were used in the comparison:

- **POOR**—if the training does not meet the criteria;
- **FAIR**—if the training content meets some of the criteria but not in full;
- **GOOD**—if the content meets the criteria.

Table 2 Details of the experts

Expert location	Expertise	Profession	Experience	Education
International	Ship recycling, IHM, management of hazardous wastes, environmental compliance, training, and international laws	Industry expert	10 years	Dip-Ing
Local	Ship recycling, maritime education, occupational health safety	Industry expert	15 years	MSc
International	Ship recycling, environmental protection, naval architecture	Academic	10 years	PhD
Local	Ship recycling, environmental economics, training, and local laws	Academic	2 years	PhD
Local	Ship recycling, local laws, maritime education, and occupational health and safety	Academic	15 years	MSc
International	Ship recycling, human factors, naval architecture, and international laws	Academic	8 years	PhD
International	Ship recycling, maritime education, training, risk management, and marine environment protection.	Academic	5 years	PhD
International	Ship recycling, yard design, and naval architecture.	Researcher	2 years	MSc

Following the gap analysis and identification of training needs, a new curriculum was developed to address the identified gap in the literature. The work carried out in this study constituted several tasks of the SENSREC WP4 Part 1 ‘Training Needs Assessment and Curriculum Development’, which was divided amongst consortium partners by means of eight tasks: (1) Data Collection on OHS & Environmental Training in Bangladesh; (2) Data Collection on OHS & Environmental Training—International practice; (3) Short assessment of workers—secondary and field data; (4) Gap Analysis with regard to national requirements and international requirements/practice; (5) Identification of Training Needs; (6) Training Methods; (7) Curriculum Development; and (8) Reporting and Training Strategy.

4 Training in ship recycling yards and comparison to international norms

In this section, training programmes in the Bangladesh ship recycling industry, established before SENSREC, are introduced. In order to attain compliance with national requirements, the Bangladesh Ship Breakers Association (BSBA) had organised a training programme for its workers and established a training institute in the vicinity of the ship recycling yards. Inactive during the visit of partners of IMO SENSREC project at the end of 2015, the training centre was located on top of the under-construction BSBA hospital.

BSBA had succeeded in establishing a training system for skilled and unskilled workers, enhancing safety awareness and provoked enthusiasm, where by October 2015, 3038 skilled workers and 1322 unskilled workers had been effectively trained. In accordance with BSBA and local experts, it had been reported that the accident rate declined; however, a substantial lack of accurate data had made it problematic to corroborate (IMO-NORAD 2015).

BSBA has also developed a tailor-made training programme by integrating resources generated during previous projects (i.e. SAFEREC and BSBA ‘Train-the-trainer’ programme on hazardous waste management and oil pollution control), in addition to consulting with local experts to complete gaps. Albeit the effort, some shortcomings were identified during the investigations. It was established that the training was not completely adapted to the sector; self-developed by local trainers and delivered according to personal availability, where a delivery schedule was implemented, yet was devoid of a comprehensive curriculum to formalise the training. Also, the training did not possess reference modules in which the content and structure were formalised with supplementary literature, where the training effectiveness was found to be highly dependent on the trainers’ capacity.

After the collection of existent data about the training, its content was assessed and scrutinised in accordance with the requirements of the IMO Hong Kong Convention and ILO requirements by experts from academia and industry. As a result, despite the merits and best efforts of SAFEREC and BSBA ‘Train-the-trainer’ programmes, numerous gaps were not addressed, specifically indicating the complex subcontracting structure and vast diversity of roles. Only a small proportion of unskilled workers were sent to training, and there were issues in the retention of trained workers. For

appropriate coordination of training, the facilities themselves are required to maintain a training register.

According to the Regulation 22 of the IMO Hong Kong Convention (2009), ship recycling facility (SRF) have to implement a comprehensive training programme for all workers, ‘including contractor personnel and employees’ (IMO 2009). Training programmes should be adapted to workers’ tasks and conducted by competent persons.

Training content must cover the following, but not limited to;

- ‘awareness and communication of information about Hazardous Materials;
- job hazard awareness, including the handling and management of Hazardous Materials;
- personal protective equipment;
- fire protection and prevention;
- emergency response and evacuation;
- safety and health training;
- environmental awareness; and
- first aid awareness (IMO 2009)’.

(Note: Additional requirements are available in the 2012 GUIDELINES FOR SAFE AND ENVIRONMENTALLY SOUND SHIP RECYCLING (Resolution MEPC.210 (63)). These guidelines were incorporated by SENSREC WP4 team for the development of a new curriculum and the related modules).

In 2003, the ILO published the document ‘Safety and health in shipbreaking: Guidelines for Asian countries and Turkey’ (ILO Guidelines). BSBA’s training content was evaluated taking into consideration ILO Guidelines.

4.1 Comparison of IMO HKC requirements and BSBA training

In the following table, IMO requirements are identified in *italic* and assessed in the context of BSBA training.

Criteria	Evaluation
<i>Training should cover all workers including contractor personnel and employees in the ship recycling facility;</i>	POOR: Current training does not cover all workers, especially contractor personnel. Most of the contractor personnel are migrant and seasonal workers who do not receive proper training. On-field observation and interviews demonstrated that workers sent to training were chosen by employers amongst their skilled and permanent workers.
<i>Training should be conducted by competent persons;</i>	POOR: Recruitment procedures for trainers were not formalised. Also, prerequisites of becoming a trainer should be defined. Despite the presence of a few experts in OHS, there was no systematic training programme to establish a sufficient pool of experts. For example, some of the trainers may not have the ship recycling industry background; this may result in low training quality, irrelevant examples, and superficial content.

Criteria	Evaluation
<i>Ship recycling yard should provide initial and refresher training at appropriate intervals;</i>	POOR: The training is only given in the beginning. At the time of the investigation, there was no refresher or any periodic training defined in the programme. Our assumption does not include internal training that is given on an ad-hoc basis by individual yards because this training is not consistent and could not be traced.
<i>Training content should include participants' evaluation of their comprehension and retention of the training;</i>	POOR: Currently, the training programme lacks a structured method for the evaluation of trainee's knowledge. Also, it was identified that there are no case studies, discussions, or projects that participants can demonstrate their gained skills and understanding.
<i>Training should be reviewed periodically and modified as necessary;</i>	FAIR: Training programme was revised in the last years due to the public interest in the industry. However, some of the content in the training is still outdated. More importantly, review procedure for the training content should be formalised and documented.
<i>Training should be documented.</i>	GOOD: Ship recycling yard that was investigated in this study keeps training records of the workers, which include the contents and the date of the training. Albeit, assessing the reliability of the training records was beyond the scope of our study, it needs to be noted that a proper training plan, which includes a job-specific training that needs matrix, is lacking in the facilities.

Specific requirements of IMO for training content.

Criteria	Evaluation
<i>Awareness and communication of information about hazardous materials;</i>	POOR: Despite its existence, the training content on the awareness of hazardous materials was found to be insufficient in comparison with needs in yards. It is important to adjust in order to avoid the illusion given to workers that they are competent with handling hazmat.
<i>Job hazard awareness, including the handling and management of hazardous materials;</i>	POOR: Job hazard training was very generic and basic. Moreover, similar to the previous requirement, the information on hazardous materials are not sufficient.
<i>Personal protective equipment;</i>	POOR: The training on the personal protective equipment was available but failed to incorporate essential requirements. A gap has been identified in the area using certified (quality-approved) PPE. Also, PPE required for HazMat protection should be detailed in order to cover all potential hazards. Moreover, masks and other PPE that can potentially be fitted incorrectly should be covered in the training.
<i>Fire protection and prevention;</i>	FAIR: the training content on fire protection and prevention is good and delivered by experts; however, more focus should be given on gas-free procedures and practical implementation on site.

Criteria	Evaluation
<i>Emergency response and evacuation;</i>	FAIR: The current training includes some content on an emergency response, but it should be improved with evacuation scenarios and case studies considering the historic accidental experience in the industry.
<i>Safety and health training</i>	FAIR: General health and safety training can be considered average and requires improvement. Topics such as long-term occupational illnesses and means of protection should be described and detailed.
<i>Environmental awareness;</i>	POOR: There is no environmental awareness training in the current programme for all worker. The existing BSBA training focuses on special categories of workers, not all of them.
<i>First aid awareness.</i>	FAIR: First aid awareness training provided is sufficient, but it is only theoretical; there should be a practical part involved in the training.

Comparison of ILO Safety and health in ship recycling: Guidelines for Asian countries and Turkey and BSBA Training Curriculum.

Criteria	Evaluation
<i>Pertinent aspects of OHS legislation, such as the rights, responsibilities, and duties of competent authorities, employers, contractors, and workers</i>	POOR: In the current training, there is no content related to worker rights, employer-contractor duties, or the duties of authorities.
<i>The nature and degree of hazards or risks to safety and health which may occur, including any factors which may influence that risk, such as appropriate hygiene practices</i>	POOR: Even though some of the risks and hazards are covered, the content is not complete and require improvement (e.g. hazardous materials and noise)
<i>The correct and effective use of prevention, control, and protection measures, especially engineering controls, and their responsibility for using such measures properly</i>	POOR: Some of the prevention and protection measures are mentioned, but it remained basic. Instructions on 'how to use' and 'when to use' are available in the training.
<i>Operating procedures while working in confined spaces</i>	POOR: Work in confined spaces is mentioned theoretically, but practical implementation is missing. Indeed, proper familiarisation of workers including procedures and related protective measures are essential.
<i>Correct methods for the handling of substances, the operation of processes and equipment, and for storage, transport, and waste disposal</i>	POOR: As mentioned before in the IMO requirements, hazardous material training lacks depth.
<i>Assessments, reviews, and exposure measurements, and the rights and duties of workers in this regard</i>	POOR: Similar to the above, this aspect has been omitted in the current training.
<i>The role of health surveillance, the rights and duties of workers in this regard, and access to information</i>	POOR: This requirement is also part of IMO HKC, but the training did not contain any information on health surveillance.
<i>Instructions on personal protective equipment as may be necessary, their significance, correct use and limitations, and in particular on factors which may show inadequacy or malfunction of the equipment, and the measures which may be required for the workers to protect themselves</i>	POOR: As mentioned in the HKC requirements, training does not cover all the PPE, it needs further improvement with more extensive content.

Criteria	Evaluation
<i>Hazard warning signs and symbols for hazardous ambient factors which may occur</i>	FAIR: In the yards, the hazard warning signs are placed, but the standards and quality of the signs can be improved. Current training covers the signage but can be improved to include all types of safety signs. Moreover, for each type of safety sign at the workplace, behaviour expected from workers can also be included in the training. It was also observed that knowledge gaps exist in the management team regarding the usage of proper safety signs. Therefore, tailored training for this level can help improve the current situation.
<i>Emergency measures, fire-fighting and fire prevention, and first aid</i>	FAIR: Training content on fire protection and prevention is good as mentioned in the previous section but it lacks the information on gas-free procedures.
<i>Appropriate hygiene practices to prevent, for example, the transmission of hazardous substances to the home or family environment</i>	FAIR: The ILO training has some information on hygiene practices and general health, but the hazardous substances are insufficient in these sections of the training.
<i>Cleaning, maintenance, storage, and waste disposal to the extent that these may cause exposure for the workers concerned</i>	POOR: The information on waste management on the current training is insufficient.
<i>Procedures to be followed in an emergency.</i>	FAIR: Emergency response training is included; however, it lacks the practical implementation and demonstration that can be conducted by individual facilities.
<i>Training should be provided to all participants at no cost and should take place during working hours for which the workers are paid by their employers. If this is not possible, the timing and other arrangements should be agreed upon between the employer and workers' representatives.</i>	POOR: Currently, training is provided for free to the participants, but only a fraction of workers attended this training. Indeed, the national regulation requires each worker to be trained and expenses covered by the employer.
<i>Employers should ensure that training and information requirements and procedures are kept under review, as part of the assessment review and documentation.</i>	POOR: Even though workers who receive training are kept under the record, there was no procedure in place to keep training content up to date, and no refreshment course was available.

5 Discussions and recommendations

In the previous sections, training gaps for the ship recycling workers were identified based on different legislation. Albeit the national regulation (2009 Verdict 6/4/11 by Bangladesh High Court and subsequent legislations) highlights the needs for training, the details of its content have not been clarified. Due to the relevant existing gaps with international requirements, SENREC has elaborated a comprehensive training programme incorporating and completing existing material.

5.1 Safety and health training approach

OHS training needs overhauling, updating, and adaptation to the audience. First, the inclusion of scenarios in risky situations and hazards is necessary to avoid the generic

approach. Second, the training method should foster a case study and hands-on exercises, as well as use multimedia resources such as videos and animations. The purpose of this approach is to engage workers with low literacy by involving them in the delivery. It is necessary as the data collected during SENSREC survey of 200 workers in 2015 underlined that more than two-thirds of workers have either no education or only primary education. However, SENSREC data showed improvement since 2005 SAFEREC, albeit assessed on a smaller sample of 85 workers.

5.2 Awareness and communication of information about hazardous materials

Enhancing the level of awareness regarding hazardous materials on board ships needs improvements to adequate preparedness and planning of dismantling and recycling operation. Awareness on Inventory of Hazardous Material (IHM) for workers and manager is essential. Indeed, IHM supports the preparation and establishment of the ship recycling plan necessary to organise work processes and facilitate safe ship recycling.

5.3 Job hazard awareness, including the handling and management of hazardous materials

The correct and effective use of prevention, control, and protection measures, especially for engineering controls, are imperative for workplace safety. Identification of hazards and safety measures must be adapted to the context of ship recycling. For example, despite being highlighted in ILO Guidelines and measures conducted by Kurt et al. (2017) showing that noise emissions from ship recycling yards are exceeding safe exposure levels, it was observed that noise protection was not addressed in ship recycling yards. Therefore, proper protection and associated training should be provided.

5.4 Personal protective equipment

Despite lacking depth (as previously assessed), instructions about personal protective equipment were included in BSBA training. However, during yard visits, it was observed that many workers did not wear appropriate PPE when performing specific tasks. For example, only some workers were wearing masks during cutting operations. Moreover, the masks in use were dust masks, which do not protect workers from hazardous substances in the fumes (e.g. heavy metals, arsenic). Protective glasses, safety boots, or boiler suits were lacking, which shows a lack of awareness, training, and concern amongst workers and management.

5.5 Fire protection and prevention

Covered fairly by experts from the local fire brigade, fire protection and prevention training can be improved by providing examples of potential causes of fire and explosion in ship recycling processes. Discussion of case studies, practical demonstrations, and use of firefighting equipment should be included in the training, particularly about firefighting in enclosed spaces (as it is required for seafarers under STCW 78 as amended).

5.6 Emergency response and evacuation

The number one priority for a ship recycling yard should always be the emphasis on prevention of any accidents and disasters. However, it is also essential to prepare staff for an emergency; in such situations, emergency response and evacuation training should be provided. For example, emergency response scenarios for different conditions should be developed and tested with workers (e.g. medical evacuation from the ship during high tide) so that workers can react swiftly and appropriately. Generic training drills on emergency and evacuation procedures must be complemented by on-site familiarisation as each ship recycling yard is different.

5.7 First aid awareness

During yard visits, it was observed that some yards covered first aid awareness with in-house teams, which does not exclude the implementation of general first aid training complemented with practical exercises.

5.8 Environmental awareness

Despite BSBA train-the-trainer on hazmat for specialised workers, there is no evidence that this issue is covered for all workers. Both workers and managers should go through extensive environmental awareness training.

5.9 Pertinent aspects of OHS legislation, such as the rights, responsibilities, and duties of competent authorities, employers, contractors, and workers

As required by 2003 ILO Guidelines, instructions on OHS relevant laws, regulations, requirements, codes of practice, instructions, and advice are an inherent part of training. Indeed, workers and managers need information about their rights, duties, and responsibilities towards OHS. Moreover, the health surveillance issue with rights and duties associated belongs to the scope of any OHS training.

5.10 Assessments, reviews and exposure measurements, and the rights and duties of workers in this regard

There is no evidence of periodic monitoring of workers' health and exposure to ship recycling hazards. Managers require training for conducting occupational hygiene measurements and taking necessary actions. For example, measurement related to respiratory hazards (due to cutting fumes), noise exposure, heat stress measurements, etc. needs to be collected to establish occupational health surveillance programme.

Other issues that should be given more detailed training are given below:

- Hygiene practices
- Working in confined spaces
- Development of standard operating procedures and conducting deviation investigation after accidents to identify the root causes of accidents

5.11 Vocational education

It is necessary to prepare workers to face numerous tasks and roles in their professional life. Each of them will work with specific equipment or machinery that involves specific knowledge of each role's specificities. Not an end in itself, vocational education should be followed by on-site training, which should clearly define the learning objectives while being organised and conducted by qualified instructors.

Finally, the vocational training must be complemented by on-site familiarisation and on-the-job training to support safety and help professionalisation of workers. Vocational Education Training developed in ShipDIGEST (2011–2013) in cooperation with Turkish Ministry of Labour for ship recycling sector in Turkey (S. A. McKenna et al. 2013) can be utilised for Bangladesh after amendments.

6 Development and implementation of the training

As previously highlighted, the training gaps constitute one aspect of the comprehensive training analysis performed by the SENSREC consortium. In order to meet the training requirements with recycling yard workers, the consortium conducted an assessment of workers to appropriate training methods (SENSREC 2015b). Finally, the consortium developed a complete curriculum supported by extensive training materials to address future training (SENSREC 2016a; SENSREC 2016b).

The training curriculum consisted of eight modules. Each module was adapted to address three levels of trainees in yards: (level 1) all workers; (level 2) additional training for skilled and specialised workers; and (level 3) awareness for managers (SENSREC 2016a; SENSREC 2016b) (Table 3).

For each module, the SENSREC consortium developed a comprehensive manual for trainers, together with a set of slides. Supplementary teaching/training material (videos, animations, drawings, pictures, etc.) and exercises/activities (hands-on exercises, demonstration of equipment, tests to verify knowledge, drills, etc.) were provided.

A 2-week pilot training activity in Bangladesh concluded the development of the material, where an assemblage of six national and international experts delivered the training. The pilot training aimed to collect feedback from attendees familiar with ship recycling operations and potential future trainers (IMO-NORAD SENSREC Project 2016a).

Twenty-one experienced, and knowledgeable trainees attended the training, whose careers include experience in ship recycling yards, government agencies, and local education establishments (IMO-NORAD SENSREC Project 2016a). Participants provided feedback on the training content and suggested improvements, together with annotations from trainer observation, where both feedback responses were incorporated to improve the overall quality of the training. Appreciated by participants, the training pilot deemed successful to support train-the-trainer courses and training for workers. As a result of the pilot, 21 potential trainers can deliver training using the SENSREC material.

In order to increase the effect and ensure the sustainability of the training, several precautions should be taken. First, well-equipped training facilities are required and some practical aspects that can be presented in selected ship recycling facilities (e.g. evacuation of workers). Indeed, practical training sections (e.g. hot work, working in a confined space, fire safety, and working at height) require specific equipment that is not

Table 3 Training modules and their contents developed in SENSREC project

Module	Definition
Module 1: ship recycling administration and regulative framework	Define international and local ship recycling practices and regulatory framework. Provide knowledge about employers' responsibilities as well as workers and employers' relationship. Recall the importance of occupational health safety management, and incidents, accidents and diseases, and reporting.
Module 2: job hazard awareness—hazard and risks	Recall notions of hazard, hazard identification, risk, and risk assessment. Appraise ship recycling-related hazards and risks, and how to mitigate these hazards.
Module 3: environmental awareness	Detail environmental awareness in the ship recycling yards. Discuss waste management, pollution impact, prevention, and response.
Module 4: inventory of hazardous materials (IHM)	Designed for skilled workers. Detail IHM principles as per the Hong Kong Convention. Discuss the use of IHM for proper interpretation of IHM and related consideration for planning and executing the ship recycling activities.
Module 5: personal protective and safety equipment	Describe PPE and their legal requirements. List various types of PPE and their purpose, the importance of using correct PPE for the type of the task (including emergency response), evaluating the condition of PPE and maintenance.
Module 6: worker wellbeing and health	Discuss workers' health and well-being in Bangladesh ship recycling industry through OHS practices. Explain the importance of hygiene and health practices as well as medical welfare support and psychological health.
Module 7: awareness and handling of hazardous materials	Discuss awareness and handling of various hazardous materials found on board end-of-life ships. Detail processes in managing such material inside yards.
Module 8: vocational education and training	Explain the use and maintenance of the equipment and machinery used in the ship recycling yards. Discuss activities work with heavy machinery and tools, hot work and its safety precautions, sorting and segregation techniques, repair and maintenance, emergency response techniques, etc.

currently available in BSBA facilities. It may not be necessary to develop new training centres as institutions dedicated to STCW training (e.g. Bangladesh Marine Academy) already possess such facilities in Chittagong.

Second, a supervisory mechanism would be required to oversee and update the training as necessary, as well as keep records of training. The under-construction Bangladesh Ship Recycling Board (BSRB) may develop such coordination system as training falls under its scope (IMO-NORAD SENSREC Project 2016b).

7 Conclusion

The adoption of the IMO's Hong Kong Convention (2009) and EU Ship Recycling Regulations (2013) tends to accelerate the willingness of major ship recycling countries to comply with international standards.

In such context, training of workers to enhance safety and facilitate compliance with international standards is vital. In this paper, following the SENSREC project, current training has been compared with international ideals. Results have shown that training in Bangladesh ship recycling industry required improvements. After a comprehensive assessment during SENSREC WP4 (2015–2017), a complete system of training has been developed by local and international experts.

A pilot training was conducted to create a pool of trainers as well as to test the training content. It is expected that shortly, and as required by national regulation, each worker will be trained in ship recycling yards. In this respect, the IMO has recently announced the second phase of the IMO-implemented project SENSREC. For 2 years, starting in 2018, SENSREC-Phase II will support capacity-building in Bangladesh and, inter alia, will use the material developed previously. However, long-term training strategy and stable funding system will be required to be established in order to ensure the sustainability of such training. It also seems noteworthy to mention that, in order to achieve proper implementation, the importance of proper training needs to be recognised by the legislators, associations, and the responsible persons of facilities. This requires awareness-raising campaigns and cooperation with local decision-makers.

Acknowledgements Research presented in this paper is conducted under the IMO-NORAD-funded SENSREC project: ‘Safe and environmentally sound ship recycling in Bangladesh’. Authors of this paper gratefully acknowledge the contribution of project partners who are not listed as authors in this manuscript.

Open Access This article is distributed under the terms of the Creative Commons Attribution 4.0 International License (<http://creativecommons.org/licenses/by/4.0/>), which permits unrestricted use, distribution, and reproduction in any medium, provided you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons license, and indicate if changes were made.

Publisher’s note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

References

- Abdullah H, Mahboob M, Biruni A (2010) Drastic expansion of ship breaking yard in Bangladesh: a cancerous tumor to the coastal environment. In: Proceedings of the International Conference on Environmental Aspects of Bangladesh (ICEAB), pp 234–237
- Abdullah HM, Mahboob MG, Banu MR, Seker DZ (2013) Monitoring the drastic growth of ship breaking yards in Sitakunda: a threat to the coastal environment of Bangladesh. *Environ Monit Assess* 185:3839–3851. <https://doi.org/10.1007/s10661-012-2833-4>
- Ahammad H, Sujauddin M (2017) Contributions of ship recycling in Bangladesh: an economic assessment. IMO-NORAD, London, UK
- Aktaruzzaman M, Chowdhury MAZ, Fardous Z, Alam MK, Hossain MS, Fakhruddin ANM (2014) Ecological risk posed by heavy metals contamination of ship breaking yards in Bangladesh. *International Journal of Environmental Research* 8:469–478
- Alam S, Faruque A (2014) Legal regulation of the shipbreaking industry in Bangladesh: the international regulatory framework and domestic implementation challenges. *Mar Policy* 47:46–56. <https://doi.org/10.1016/j.marpol.2014.01.022>
- Alli BO (2008) Fundamental principles of occupational health and safety. International Labour Organization (ILO),
- Amin SMN, Billah M (2007) Environmental impacts of ship scrapping in Bangladesh. *Pennsylvania Geographer* 45:113–130

- Andersen AB, Bjømbom E, Sverud T (2000) Decommissioning of ships – environmental standards. Det Norske Veritas,
- Arslan O, Kurt RE, McKenna SA, Kececi T EU (2013) Project: ship DIGEST and the role of Aliaga ship recycling company on development of the Turkish-ship dismantling industry. In: International conference on ship recycling, Malmö, Sweden, WMU,
- Bailey P, Rai P (1999) The social and labour impact of globalization in the manufacture of transport equipment: report for discussion at the tripartite meeting on the social and labour impact of globalization in the manufacture of transport equipment, Geneva, 2000. International Labour Organization,
- Courtice MN, Demers PA, Takaro TK, Vedal S, Ahkter Ahmad SK, Davies HW, Siddique Z (2011) Asbestos-related disease in Bangladeshi ship breakers: a pilot study. *Int J Occup Environ Health* 17:144–153
- Dhar K, Dutta S, Anwar MN (2012) Biodegradation of petroleum hydrocarbon by two *Aspergillus* spp. and two *Penicillium* spp. isolated from the contaminated soil and water of ship breaking yard. *Asian Journal of Microbiology, Biotechnology and Environmental Sciences* 14:143–148
- DOE (2011) The ship breaking and recycling rules
- Fakhruddin A, Talukdar M, Hossain M (2015) Environmental impacts of ship breaking and recycling industry of Sitakunda, Chittagong, Bangladesh *Advances in Natural Science* 8:51–58
- FIDH, YPSA, NGO Ship Breaking Platform (2008) Childbreaking yards child labour in the ship recycling industry in Bangladesh
- FIDH IM (2002) Where do the floating dustbins' end up? Labour rights in shipbreaking yards in South Asia: the cases of Chittagong (Bangladesh) and Alang (India). Report,
- Frey RS (2015) Breaking ships in the world-system: an analysis of two ship breaking capitals. Alang-Sosiya, India and Chittagong, Bangladesh 2015:25–49. <https://doi.org/10.5195/jwsw.2015.529>
- Galley M (2014) Shipbreaking: hazards and liabilities. Springer,
- Gregson N, Crang M, Ahamed F, Akhter N, Ferdous R (2010) Following things of rubbish value: end-of-life ships, 'chock-chocky' furniture and the Bangladeshi middle class consumer. *Geoforum* 41:846–854. <https://doi.org/10.1016/j.geoforum.2010.05.007>
- Haque M (2016) Occupational health and safety in the ship-breaking industries of Bangladesh. *Governance in South Asia*, In, pp 157–177. <https://doi.org/10.4324/9781315394268>
- Hasan AB, Kabir S, Selim Reza AHM, Nazim Zaman M, Ahsan A, Rashid M (2013a) Enrichment factor and geo-accumulation index of trace metals in sediments of the ship breaking area of Sitakund Upazilla (Bhatiary–Kumira), Chittagong, Bangladesh. *J Geochem Explor* 125:130–137. <https://doi.org/10.1016/j.gexplo.2012.12.002>
- Hasan AB, Kabir S, Selim Reza AHM, Zaman MN, Ahsan MA, Akbor MA, Rashid MM (2013b) Trace metals pollution in seawater and groundwater in the ship breaking area of Sitakund Upazilla, Chittagong, Bangladesh. *Mar Pollut Bull* 71:317–324. <https://doi.org/10.1016/j.marpolbul.2013.01.028>
- Hossain KA (2015) Overview of ship recycling industry of Bangladesh *Journal of Environmental & Analytical Toxicology* 2015
- Hossain MK, Hossain SM, Meaze AMH (2010) Assessment of radiological contamination of soils due to shipbreaking using HPGe digital gamma-ray spectrometry system. *J Environ Prot* 01(01):5. <https://doi.org/10.4236/jep.2010.11002>
- Hossain MM, Rahman MA (2010) Ship breaking activities: threats to coastal environment and fish biodiversity. pp. 23–42
- Hossain MMM, Islam MM (2006) Ship breaking activities and its impact on the coastal zone of Chittagong. Bangladesh: towards sustainable management
- Hossain MS, Chowdhury R, Jabbar MA, Saifullah ASM, Aatur Rahman M (2008) Occupational health hazards of ship scrapping workers at Chittagong Coastal Zone. *Bangladesh* vol 35
- Hossain MS, Fakhruddin ANM, Chowdhury MAZ, Gan SH (2016) Impact of ship-breaking activities on the coastal environment of Bangladesh and a management system for its sustainability. *Environ Sci Pol* 60: 84–94. <https://doi.org/10.1016/j.envsci.2016.03.005>
- Hossain S (2011) Ship breaking and recycling industry in Bangladesh - towards sustainable development to mitigate environmental hazards
- ILPI ILaPI (2016) Shipbreaking practices in Bangladesh, India and Pakistan
- IMO-NORAD (2015) Safe and environmentally sound ship recycling SENSREC, WP4, part I. In: IMO
- IMO-NORAD SENSREC Project (2016a) Report on pilot training of trainers. LONDON, UK
- IMO-NORAD SENSREC Project (2016b) Training sustainability strategy. LONDON, UK
- IMO (2009) The Hong Kong international convention for the safe and environmentally sound recycling of ships. International Maritime Organization,

- Islam KL, Hossain MM (1986) Effect of ship scrapping activities on the soil and sea environment in the coastal area of Chittagong, Bangladesh. *Mar Pollut Bull* 17:462–463. [https://doi.org/10.1016/0025-326X\(86\)90836-2](https://doi.org/10.1016/0025-326X(86)90836-2)
- Jobaid MI, Khan MM, Haque AKMK, Shawon IA (2014) Ship recycling and its environmental impact: a brief overview of Bangladesh *IOSR Journal of Business and Management (IOSR-JBM)* Volume 16, :PP 31–37
- Karim M (2009) Violation of labour rights in the ship-breaking yards of Bangladesh: legal norms and reality. *Int'l J Comp Lab L & Indus Rel* 25:379
- Khan I, Chowdhury H, Alam F, Kumar A (2012) Sustainable design of ship breaking industry in developing countries *Asian Journal of Water, Environ Pollut* 9:1–11
- Khan MAA, Khan YSA (2003) Trace metals in littoral sediments from the North East Coast of the bay of Bengal along the ship breaking area, Chittagong, Bangladesh. *J Biol Sci* 3:1050–1057
- Kibria G, Hossain MM, Mallick D, Lau TC, Wu R (2016) Monitoring of metal pollution in waterways across Bangladesh and ecological and public health implications of pollution. *Chemosphere* 165:1–9. <https://doi.org/10.1016/j.chemosphere.2016.08.121>
- Kurt RE, McKenna SA, Gunbeyaz SA, Turan O (2017) Investigation of occupational noise exposure in a ship recycling yard. *Ocean Eng* 137:440–449. <https://doi.org/10.1016/j.oceaneng.2017.03.040>
- Kutub MJR, Falgunee N, Nawfee SM, Rabby YW (2017) Ship breaking industries and their impacts on the local people and environment of coastal areas of Bangladesh. *De Gruyter Open*
- Mashreqe D (2005) Workers in shipbreaking industries: a base line survey of Chittagong (Bangladesh) YPSA (Eds)
- Mizanur Rahman SM, Mayer AL (2015) How social ties influence metal resource flows in the Bangladesh ship recycling industry *Resources, Conservation and Recycling* 104, Part A:254–264 doi:<https://doi.org/10.1016/j.resconrec.2015.07.022>
- Mohammad S (2013) Material flow analysis for recycling and waste management system in Bangladesh
- Muhibbullah M (2013) Health hazards and risks vulnerability of ship breaking workers. A case study on Sitakunda ship breaking industrial area of Bangladesh *Global Advanced Research Journal of Geography and Regional Planning* 02(08):172–184
- NGO Ship Breaking Platform (2017) NGO ship breaking platform annual report-2016
- Nøst TH, Halse AK, Randall S, Borgen AR, Schlabach M, Paul A, Rahman A, Breivik K (2015) High concentrations of organic contaminants in air from ship breaking activities in Chittagong. *Environ Sci Technol* 49:11372–11380
- Pasha M, Hasan M, Rahman I, Hasnat A Assessment of ship breaking and recycling industries in Bangladesh—an effective step towards the achievement of environmental sustainability. In: International conference on agricultural, environmental and biological, 2012
- Rahman SMM, Handler RM, Mayer AL (2016) Life cycle assessment of steel in the ship recycling industry in Bangladesh. *J Clean Prod* 135:963–971. <https://doi.org/10.1016/j.jclepro.2016.07.014>
- Rahman SMM, Mayer AL (2016) Policy compliance recommendations for international shipbreaking treaties for Bangladesh. *Mar Policy* 73:122–129. <https://doi.org/10.1016/j.marpol.2016.07.012>
- Rousmaniere P, Raj N (2007) Shipbreaking in the developing world: problems and prospects. *Int J Occup Environ Health* 13:359–368
- McKenna SA, Kurt RE, Turan O (2013) Ship digest: vocational education for the ship dismantling industry. In: International Conference on Ship Recycling, Malmö, Sweden, WMU, pp 23–32
- SAFEREC (2005) Ship recycling in Bangladesh, findings on the baseline survey of the ship recycling yards, safe and environment friendly ship recycling project (SAFEREC). International Labour Organisation, Government of the People's Republic of Bangladesh, United Nations Development Programme,
- 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. Department of Geography and Environmental Studies, University of Chittagong, Bangladesh, Chittagong MS Research Project
- Sarraf M, Stuer-Lauridsen F, Dyoulgerov M, Bloch R, Wingfield S, Watkinson R (2010) The ship breaking and recycling industry in Bangladesh and Pakistan. World Bank,
- SENSREC (2015a) Safe and environmentally sound ship recycling in Bangladesh (SENSREC) Project, IMO-NORAD
- SENSREC (2015b) Training needs and methods identification of training needs. In: IMO-NORAD (ed.) Safe and Environmentally Sound Ship Recycling in Bangladesh – Phase I
- SENSREC (2016a) Curriculum and training strategy. LONDON, UK
- SENSREC (2016b) Pilot training of trainers
- Shameem KA (2012) The role of the ship breaking industry in Bangladesh and its future with special emphasis on capacity building through education and training
- ShipDIGEST (2011–2013) Ship Dismantling insight by generating environmental and safety training

- Siddiquee NA, Parween S, Quddus MMA, Barua P (2012) Heavy metal pollution in sediments at ship breaking area of Bangladesh. In: Subramanian V (ed) Coastal environments: focus on Asian regions. Springer Netherlands, Dordrecht, pp 78–87. https://doi.org/10.1007/978-90-481-3002-3_6
- Sujauddin M, Koide R, Komatsu T, Hossain MM, Tokoro C, Murakami S (2015) Characterization of ship breaking industry in Bangladesh. *J Mater Cycles Waste Manag* 17:72–83. <https://doi.org/10.1007/s10163-013-0224-8>
- Sujauddin M, Koide R, Komatsu T, Hossain MM, Tokoro C, Murakami S (2017) Ship breaking and the steel industry in Bangladesh: a material flow perspective. *J Ind Ecol* 21:191–203. <https://doi.org/10.1111/jiec.12423>
- The Daily Star (2016) Life at death yard. <http://www.thedailystar.net/frontpage/life-death-yard-202612>
- The Maritime Executive (2016) Bangladesh high court summons shipbreakers. <https://maritime-executive.com/editorials/bangladesh-high-court-summons-shipbreakers#gs.=DezUAs>. Accessed 22 June 2018
- World Bank (2010) The ship breaking and recycling industry in Bangladesh and Pakistan. World Bank, Zakaria NG, Ali MT, Hossain KA (2012) Underlying problems of ship recycling industries in Bangladesh and way forward. *J Nav Archit Mar Eng* 9:91–102