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SID 5 Research Project Final Report

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Project identification

1. Defra Project code: WR1110
2. Project title:
   POTENTIAL TRANSITIONAL TECHNOLOGY SOLUTIONS FOR ENVIRONMENTALLY SOUND SHIP RECYCLING IN DEVELOPING COUNTRIES
3. Contractor organisation(s): Golder Associates (UK) Ltd
4. Total Defra project costs (agreed fixed price): £ 41,832
5. Project: start date .... 11 March 2009
   end date .... 26 June 2009

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(a) When preparing SID 5s contractors should bear in mind that Defra intends that they be made public. They should be written in a clear and concise manner and represent a full account of the research project which someone not closely associated with the project can follow.

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Executive Summary

7. The executive summary must not exceed 2 sides in total of A4 and should be understandable to the intelligent non-scientist. It should cover the main objectives, methods and findings of the research, together with any other significant events and options for new work.

The recycling of ships is a growing international issue where focus is being placed on ensuring that such works are carried out safely and with minimal damage to the surrounding environment. The majority of ship recycling, with the maximisation of salvaging metals and reusable materials, is currently carried out in countries such as Bangladesh, India and Pakistan, where working conditions and environmental protection are often not prioritised

The purpose of this DEFRA funded project was to identify, assess and produce guidance notes on a selected number of appropriate transitional technology solutions for application to environmentally sound ship recycling, which are suitable for use in such countries. This is consistent with the Government's stated aims in paragraphs 19-21 of the UK Ship Recycling Strategy with respect to upgrading of facilities. In particular paragraph 20 which states "Government will work to develop suitable projects to promote responsible ship recycling….." and paragraph 21 where "Government will also support development of a technical co-operation project, based on the Basel Convention Guidelines, to assist in the upgrade of standards at facilities in developing countries and to expand the provision of Environmentally Sound Management compliant ship recycling capacity".

The focus of this project has therefore been on developing a number of options which could be readily adopted by the ship recycling facility operators and workers. Since the use of heavy, expensive and complicated machinery is typically not appropriate, simpler, more transitional technology solutions are sought.

The research identified a number of straight-forward, transitional technology options and developed methodologies in which the ship recycling work can continue but with safer working conditions for the surrounding environment as well as the workers. In undertaking the research, site visits were undertaken to the Alang ship recycling yards in Gujarat, India and stakeholder engagement was undertaken with a variety of individuals and organisations from operators of the ship yards, national and international NGOs, inter-governmental organisations. Additionally, a literature review of currently available material on ship recycling in India, Bangladesh and Pakistan was undertaken. From this work, a number of key environmental, health and safety concerns were identified and the generally used environmental control mechanisms determined and assessed against minimum environmental control mechanisms (the new IMO Convention requirements and UK policy and regulations). Gaps were identified where there was opportunity to develop achievable interim measures for environmental, health and safety improvement until the IMO Convention comes into force. From a list of 18 key issues initially identified, seven themes for Guidance Notes were selected as priority areas based on identified need and opportunity for up-take at the sites. Guidance notes for these seven themes have been written as a basis for conversion into practical guidance documents and presentation to international negotiating bodies and implementing agencies.

The transitional technology solutions developed for the seven themes focussed on being relatively easy to implement at the ship recycling yards by suggesting the use of materials and equipment typically arising from ship recycling activities.

Specifically, the Guidance Note themes and proposed solutions are:

Spill prevention and clean-up procedures

A drain down of all oils and fuels in pipes back to storage tanks is proposed for spill prevention, followed by flushing of tanks and pipework using heated water or jet spray. Collected oils and fuels would then be stored in accordance with the Onsite Storage of Residues Guidance Note. Provision of oil spill kits is proposed for dealing with spills. Materials normally freely available at ship recycling sites make up most of the solution, with the main cost involved in provision of water pumps and jet washers, expected to be in the range of $5,000.

Hazardous Materials Identification and Inventories

A checklist of hazardous materials, based on those identified in the Hong Kong Convention and utilising images of individual materials for ease of identification, is proposed. A survey of the incoming ship on arrival by trained workers using the checklist would be undertaken, following procedures for marking up and colour coding hazardous materials on the ship. Safe storage of removed hazardous materials would then be in accordance with the Onsite Storage of Residues Guidance Note. Apart from the small cost of developing the checklists the main change proposed is in training selected workers in identification and handling of hazardous materials.

Onsite storage of residues

The designation of an impermeable floored area away from dismantling operations for residue storage is proposed. The separation of materials within the storage area and clear signage around the area would be the main cost of this proposed solution, as existing materials available on-site are proposed for use as storage vessels e.g. used oil drums or ship's tanks would result in low storage costs. Specific storage arrangements for asbestos are proposed, including sealing in tarpaulin or plastic sheeting available on-site and wetting of asbestos whenever it is to be moved. Management of the storage area by selected workers and the provision of water and fire extinguishers would be the main cost, estimated at between $200 and $400.

$400.

Working at height incorporating prevention of falls from height

As it is not possible to eliminate working at height it is proposed that risk is managed through a safe system of work, following ILO Guidance. Daily updating of the ship's General Arrangement diagram would highlight access routes clearly and a work plan would be used as reference before working at a height to identify danger areas. The cost of this solution would be low and it is therefore expected that uptake of the proposed solutions would be relatively easy for the ship yard operators.

Procedures for handling stored energy systems including cable management

Reducing the risk from electrical and mechanical stored energy systems is relatively straightforward but requires qualified personnel. The proposed solution involves undertaking an inspection of the ship on arrival and a follow-up to release the stored energy where applicable. Cable management is more complicated and may be the most difficult to implement as damage is often from within and is inherently difficult to spot. The solution proposed involves an inspection regime and decrease in cable loads by use of a snatch block and, where appropriate, use of the practice of 'end-to-ending'. The cost of qualified personnel for cable inspection is estimated to be in the range of $500 to $1,000. Expected costs of non-destructive test equipment are in the range of $3,000 to $6,000 per year and the cost of a snatch block fitted to a permanent structure in the region of $20,000. However, the ship recycling yard may be able to source some or all of the equipment required, thereby greatly reducing the cost.

Manual lifting

This Guidance Note proposes alternatives to manual lifting using winch and tirfor arrangements and, where there is no alternative to manual lifting, safe practices. These safe practices involve only an awareness of the dangers and good practice when lifting and therefore can be implemented at minimal cost. The approach using a winch will require purchase of a suitable winch and rope, costing in the region of $1,500, though it is possible that one could be found onboard the ship. The option of utilising a tirfor and rope will cost approximately $950, with the possibility that a capstan could be found onboard the ship and dismantled to use for this purpose. Two solutions are proposed for large metal plate handling: the first utilising a loading machine and magnet. If a telescopic handler or other suitable loading machine is available the cost of this solution would be in the range of $6,000. The second proposes use of a ramp, a winch and tirfor and magnetic lifters. The cost of this solution would be in the range of $2,000 to $2,500.

Access incorporating confined spaces and illumination

In terms of illumination and when electric lighting is not available, this Guidance Note proposes a system of hole-cutting to allow in natural light and gives a safe procedure for this. A General Arrangement Plan is suggested as a method of clearly defining and communicating access and exit routes onboard the ship. An initial assessment on arrival of the ship's confined spaces is proposed, combined with clear, picture-based warning signs. An entry permit scheme is then suggested in order to manage the risks involved in working in confined spaces, with air quality testing procedures outlined. The main cost involved in implementing these solutions would be connected to training, with the addition of an estimated cost of around $250 for oxygen test equipment. This solution should therefore be relatively straightforward to implement.

Project Report to Defra

8. As a guide this report should be no longer than 20 sides of A4. This report is to provide Defra with details of the outputs of the research project for internal purposes; to meet the terms of the contract; and to allow Defra to publish details of the outputs to meet Environmental Information Regulation or Freedom of Information obligations. This short report to Defra does not preclude contractors from also seeking to publish a full, formal scientific report/paper in an appropriate scientific or other journal/publication. Indeed, Defra actively encourages such publications as part of the contract terms. The report to Defra should include:

- the scientific objectives as set out in the contract;
- the extent to which the objectives set out in the contract have been met;
- details of methods used and the results obtained, including statistical analysis (if appropriate);
- a discussion of the results and their reliability;
- the main implications of the findings;
- possible future work; and
- any action resulting from the research (e.g. IP, Knowledge Transfer).

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LIST OF APPENDICES

1.0 AIMS AND OBJECTIVES

The aim of the project was to identify, assess and produce guidance on a selected number of appropriate transitional technology solutions for application to support environmentally sound ship recycling, these being suitable for ship recycling operations in developing countries.

The project comprised of four objectives:

- The development of a contextual approach for identifying good practice transitional techniques for environmentally sound management at ship recycling facilities in developing countries, based on existing national and international requirements and guidance;
- The gaining of a robust understanding of the key health, safety and environmental issues at the ship recycling sites in developing countries to support the identification of transitional techniques;
- Based upon an evaluation of health, safety and environmental performance of the key environmental issues, the objective was to propose a range of transitional techniques that would contribute towards environmentally sound ship recycling practices and to assist in the development of practical guidance documents as well as inform policy development. This goal also included assessing the ease of uptake for the possible solutions as well as identification of any barriers to implement; and
- Production of a series of guidance notes on each specific option that could form the basis for conversion to practical guidance documents suitable for submitting to intergovernmental bodies such as the International Maritime Organisation (IMO).

2.0 EXTENT TO WHICH THE PROJECT OBJECTIVES WERE MET

The project objectives were fully met, leading to the development of seven guidance notes, where the selection of key issues was based on desk studies and site visits to ship recycling yards at Alang Beach, India.

During the early phase of the project, it was considered appropriate to integrate the development of the conceptual Environmentally Sound Management (ESM) system with the evaluation process for identification of key issues. Thus the conceptual ESM was used to support the identification of key environmental concerns, determine potential minimum environmental control mechanisms, provide a gap analysis of issues and to assess the effectiveness of meeting gaps with improved environmental management at the ship recycling yards. This enabled the results of the site visits and stakeholder engagement activities to be integrated into the ESM and reduce duplication of effort.

3.0 BACKGROUND

The recycling of ships is a growing international issue where focus is being placed on ensuring that such works are carried out safely and with minimal damage to the surrounding environment. The majority of ship recycling, with the maximisation of salvaging metals and reusable materials, is currently carried out in countries such as Bangladesh, India and Pakistan, where the working conditions and environmental protection are often not prioritised.

The purpose of this Defra funded project was to identify, assess and produce guidance on a selected number of appropriate transitional technology solutions for application to environmentally sound ship recycling which are suitable for use in such countries. This is consistent with the Government's stated aims in paragraph 19-21 of the UK Ship Recycling Strategy with respect to upgrading of facilities. In particular; paragraph 20, which states "Government will work to develop suitable projects to promote responsible recycling …" and paragraph 21, "Government will also support development of a technical co-operation project, based on the Basel Convention Guidelines, to assist in the upgrade of standards at facilities in developing countries and to expand the provision of Environmentally Sound Management compliant ship recycling capacity."

The focus of the work has therefore been on developing a number of options which could be readily adopted by the ship recycling facility operators and workers. Since the use of heavy, expensive and complicated machinery is typically not found appropriate, then simpler, more transitional technology solutions are sought.

In order to develop these guidance documents, site visits to ship recycling yards in India (Alang, Gujarat) have been conducted to both understand current working practices as well as identify key environmental and health & safety issues that would need addressing. The guidance documents were then developed with key experts that have extensive experience in ship recycling, decontamination and dismantling, waste management, environmental protection and pollution control. Prior to being used in recipient ship yards by operators and workers, these notes will need further development of the content, with elaboration of the guidance and translation into appropriate languages, as well as developing pictorial information to support the actual guidance, etc.

4.0 METHODOLGY

The methodology developed to achieve the project objectives is detailed below.

4.1 Contextual Approach

Objective 1: *"Develop a contextual approach for identifying good practice transitional techniques for environmentally sound management at ship recycling facilities in developing countries, based on existing requirements and guidance."*

Taking into account the existing legislation, requirements and guidance for the relevant developing countries (India, Bangladesh and Pakistan), and to gain a robust understanding of the key environmental issues at the ship recycling yards, a questionnaire was developed for use in the site visits in India (Objective 2). During this task, the main themes of a conceptual ESM system were developed and the resulting key issues integrated into the questionnaire.

The following sub-tasks comprised this project activity.

4.1.1 Project Kick-off

Following a kick-off meeting at Golder’s Nottingham office, which introduced the project team to the project objectives, a brainstorming session was undertaken to identify issues relevant to ship-recycling in India, Bangladesh and Pakistan. A matrix was drawn up to help prioritisation of the issues.

4.1.2 Literature Review

A literature review was undertaken of existing work and literature to gain an understanding of both current working practices at ship recycling sites in Pakistan, India and Bangladesh, as well as a comprehension of appropriate Environmental Sound Management systems for ship recycling yards in these countries.

The literature review included available guidelines, protocols and legislation taken from both web links as well as from Golder’s contacts, and the key issues identified are summarised in **Section 5.0 Results**. The literature review identified the most frequently reported concerns in relation to the environment, health and safety, what working procedures and norms were typically in place at the yards, as well as risk assessment methodologies that had been adopted in previous and ongoing work.

4.1.3 Conceptual Environmentally Sound Management Systems

At this initial stage, a thorough understanding of the key issues pursuant to a conceptual ESM was gained from the literature review, as well as Golder’s own experiences of ship recycling operations. From the brainstorming notes and literature review, a list of relevant key environmental, health and safety concerns was derived which provided a starting point for key elements of a conceptual ESM system, and formed the basis from which the questionnaire for site visits was drawn up, as described above.

4.1.4 Development of Questionnaire

From the outputs of the brainstorming notes and literature review, a list of issues for further investigation during the site visits was derived. From this, a questionnaire was developed to provide a comprehensive checklist for the visits to Ship Recycling Yards and for consultation with various stakeholders involved with ship recycling in India, Bangladesh and Pakistan. The questionnaire was reviewed by the technical team members and discussed with Golder’s Ship Recycling Yard Auditor prior to the site visits taking place.

4.2 Understanding of Environmental, Health and Safety Issues

Objective 2: *"Gain a robust understanding of the key health, safety and environmental issues at the ship recycling sites in developing countries to support the identification of transitional techniques."*

Within the timescale of this project, i.e. 4 weeks for the research phase, an understanding of current practice at ship breaking and recycling yards was derived, in particular through site visits and stakeholder interviews at the Alang Ship Yards in Bhavnagar, Gujarat, India, as well as through a literature review and stakeholder discussions of those working in Bangladesh and Pakistan. This, together with the outputs from the literature review, provided a basis for the selection of seven transitional technologies with a reserve list of three further issues.

4.2.1 Site Visits and Stakeholder Consultation

It was initially proposed that site visits would be undertaken in India, Pakistan and Bangladesh. However, a review of travel and security risks at the time of the proposed site visits, based on information provided by a travel, medical and security information provider and from applying Golder's internal Health and Safety Environment Plan (HASEP) procedures, it was decided that working in Pakistan and Bangladesh was of sufficiently high risk to not proceed at that particular time. Golder therefore proposed, with the endorsement of Defra, to focus the site visits on the Alang Ship Yards in Bhavnagar, Gujarat, India starting 18 April 2009.

Stakeholders in Bangladesh and Pakistan were instead contacted. These stakeholders comprised of locally active NGOs, law associations, health and safety organisations, international NGOs and other organisations associated with ship recycling in these countries. Details of stakeholders can be found in the **Section 5.0 Results** of this report. It should be noted, that in spite of various attempts to contact these organisations both by email (all correspondence was initiated by email drafted and agreed with Defra prior to use) and telephone, the response from many of them was limited. This was believed to have been as result of the organisations preparing for the IMO Ship Recycling conference which was held in Hong Kong, May 2009. Additionally, a number of Indian, Bangladeshi and Pakistani organisations, particularly those actively engaged in ship breaking and recycling, were not prepared to speak to Golder. As a consequence of the poor response to the stakeholder consultation, the consultation results should be treated with caution.

The outputs of the site visits and stakeholder engagement fed into the selection process for key issues, in particular in confirming or identifying further gaps in environmental, health and safety practices, and where there was opportunity for the development of transitional technology solutions.

4.3 Transitional Technology Options

<u>Objective 3</u>: *"Based upon an evaluation of health, safety and environmental performance of the key environmental issues, the objective is to propose a range of transitional techniques that will contribute towards environmentally sound ship recycling practice to assist in the development of practical guidance documents as well as inform policy development. This goal also includes assessing the ease of uptake for the possible solutions as well as identification of any barriers to implement."*

4.3.1 Development of an Evaluation Matrix

The key themes of a conceptual ESM provided a useful input to the evaluation matrix for assessment of each of the identified environmental, health and safety concerns.

4.3.2 Short List

The evaluation process included an assessment of the environmental, health and safety issues identified in the previous task against a selection of criteria put forward by the Defra team.

From discussions with the Defra team a short list of key issues/concerns was agreed, together with a reserve list. This reserve list was produced in case any of the short listed issues proved to be already dealt with by other organisations, and thus a reserve list issue could be a substitute. The short-listed issues were selected for development into Guidance Notes.

4.4 Guidance Notes

<u>Objective</u>: *"Produce a series of guidance notes on each specific option that can form the basis for conversion to practical guidance documents suitable for submitting to intergovernmental bodies such as the IMO."*

A series of seven guidance notes were developed, one for each of the key issues included in the short-list. Each guidance note was written in a format suitable for use as a basis for conversion to practical guidance documents and presentation to international negotiating bodies and implementing agencies. The technical content has been focused on the development of techniques that are capable of being readily understood and implemented with simple instructions, taking into account the working conditions at the ship recycling yards in the target developing countries.

5.0 RESULTS

5.1 Contextual Approach

5.1.1 Literature Review

A literature review was undertaken to gain an understanding of current work practices at the target ship recycling yards as well as key themes of what would constitute an appropriate Environmental Sound Management systems for ship recycling yards in developing countries.

The literature review included currently available guidelines, protocols and legislation and key issues identified are summarised below.

The main concerns in relation to ship yard workers' safety is the general absence of basic precautions and work planning, including, but not restricted to:

- Insufficient or no training;
- Insufficient or no personal protection equipment;
- Insufficient or no monitoring of work operations; and
- Insufficiencies in safe working and welfare facilities[1].

Due to the absence of norms concerning the condition that the vessel should be in when it arrives for recycling, the vessel represents in itself a number of potential risks. Basic risk-reducing or eliminating measures are often ignored and ultimately accidents occur. Some examples are:

- Access to confined space and non-breathable atmospheres;
- Hot work in explosive atmosphere; and
- Uncontrolled closedown of systems (e.g. the discharge of CO_2 from fire-fighting systems)[2].

Lack of coordination in work procedures, the absence of safe working facilities and the absence of safety controls, for example with cutting tools, represent a risk of harm and injuries to workers. Accident reporting information is often unobtainable and unreliable. Published statistical data on fatalities differ by factors of between 5 and 10 between sources[3]. The lowest reported figures suggest an annual fatality rate of 1 per cent (caused by accidents alone). Reported non-fatal incidents suggest a lower accident frequency rate for ship recycling than that for ship repair and shipbuilding. In the author's opinion, comparing the standards adopted by these two latter activities suggests that there are considerable gaps in non-fatal reporting in ship recycling activities.

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1 Listed in ILO publication "worker safety in the ship breaking industry"

2 Listed in ILO "Safety and Health in Shipbreaking"

3 ILO "worker safety in Shipbreaking"

The main elements of risk affecting workers' health appear to be:

- The nature of the work procedures adopted (hard manual labour involving heavy lifting, etc.);
- Long-term exposure caused by working operations and lack of personal protective equipment (PPE); and
- Exposure to hazardous substances/toxins.
- Discharges and emissions to sea, sediments, ground and air cause both acute and long-term pollution. The lack of containment to prevent toxins from entering the environment represents a general threat to surrounding ecologies and ecosystems[4].

It is also observed that the conditions in Bangladesh and India can be enhanced with the upgrade and enforcement of relevant environmental standards and worker safety. Bangladesh has shown progress in other labour intensive industries such as the ready-made garments industry where issues of child labour, lack of safety for worker and waste management have improved[5].

5.1.2 Development of Questionnaire

A questionnaire for use during site visits and interviews with individuals and organisations met during these visits was developed from the outputs of the brainstorming notes and literature review. Prior to use, the questionnaire was discussed in detail with Golder's Ship Recycling Yard Auditor to address any clarifications and specific requirements.

The questionnaire template can be found in **Appendix 1**.

5.1.3 Conceptual Environmentally Sound Management System

At this stage, the key themes for a conceptual ESM were developed in the form of an initial identification of key environmental, health and safety issues typically encountered with ship recycling in developing countries. These issues/concerns were identified through the Golder team brainstorming and literature review. During this activity, it was considered beneficial to include the outcome of the site visits and stakeholder engagement with these key themes, which could then be utilised in the evaluation process for identifying the key issues to develop as Guidance Notes.

The key issues identified at this stage are provided below:

- Regulation and Compliance: International and national regulation and legislation known, system in place, contracts exist, ownership of land;
- Pre-arrival Preparation: preparation for beaching, procedure for removal of ballast, valuables/salvageables, bilge tanks, marine ecology, health and welfare of workers;

4 Listed in ILO "Safety and Health in Shipbreaking"

5 Anecdotal evidence from local workers

- Works Planning: organisation of work and labour, impact on fisheries/livelihoods of others, equipment use, procedures and maintenance;
- General Working Conditions: accident and death rates, welfare of workers;
- Decontamination / Making Safe: characterisation and handling oil, stored energy, asbestos, spill procedures, PPE;
- Working Methods: procedures and awareness of safe procedures, availability of PPE, confined spaces, drinking/smoking/HIV;
- Waste Management: organisation, hazardous wastes, oils, etc., resale markets; and
- Environmental Control: emissions to air, land and water.

As mentioned above, these issues were developed into a more detailed questionnaire for use during the site visits to Alang, Gujarat, India and with various stakeholders engaged during these visits.

5.2 Understanding of Environmental, Health and Safety Issues

5.2.1 Site Visits and Stakeholder Consultation

Golder undertook site visits to Alang, Gujarat, India between the 24th and 29th April 2009. During the course of this period Golder visited the following locations and spoke to the stakeholders listed below:

Summary of sites visited:

- Ship recycling plots at Alang and Nitin, Gujarat, India.

Summary of stakeholders interviewed:

- Owners of Alang ship recycling yard and member of the Ship Recycling Industries Association (India) (who wished to remain anonymous);
- Owner of an Alang steel rolling mill that utilising recycled steel from the ship recycling (who wished to remain anonymous);
- Two other owners of ship recycling yards in Alang (who wished to remain anonymous);
- Dr Pandya, Red Cross Association;
- A buyer and seller of recycled kitchen equipment from the recycled ship; and
- Local people in Alang.

Note that a number of stakeholders only agreed to participate in conversations on agreement that they were not identified.

In addition, Golder contacted a number of organisations in Bangladesh and Pakistan, as well as international bodies working on issues of ship recycling. The following is a summary of the stakeholders contacted:

Organisation	**Outcome**
The Young Power in Social Action (a Bangladeshi NGO working on ship breaking / recycling);	Feedback received
Bangladesh Environmental Lawyers Association	Feedback received
Bangladesh Occupational Safety, Health and Environment Foundation	Contacted but no feedback provided
The NGO Platform on Ship Breaking and the NGO Platform on Ship Breaking, Bangladesh	Contacted but unable to speak to relevant person
A ship breaking/recycling operator in Gadani, Pakistan	Contact made but did not want to discuss the project with us
The secretariat of the Basel Convention	Contacted but no feedback because preparing for IMO conference
Lloyds Register	Contacted but no feedback because preparing for IMO conference
The International Maritime Organisation (IMO)	Feedback received
The European Commission	Contacted but no feedback because preparing for IMO conference
The World Bank	Feedback received
Germanischcher Lloyd	Contacted but no feedback because preparing for IMO conference
Miljoverndepartmentet	Contacted but no feedback because preparing for IMO conference
V Ships	Feedback received

It should be noted that in spite of considerable effort to contact all of the above stakeholder, initially by email and then by telephone, not all of the above were willing to discuss their involvement in ship recycling with us and a number were busy preparing for the IMO International Conference on the Safe and Environmentally Sound Recycling of Ships meeting in May 2009.

From Golder’s site visits to Alang, Gujarat, India, and from the discussions and correspondence with the various stakeholders identified above, a number of issues and concerns were identified. The key issues were:

- Falling from height: people falling from height/objects falling on people from height was identified as the most important issue, with cordoning-off generally not undertaken and crude pulley systems using knotted ropes in use;
- Fire and heat was an issue but from conversations with stakeholders incidents of heat, fire and explosion had reduced as a result of local and international pressure for improvements to health and safety conditions;
- Discharges and spills to the surrounding environment: some procedures exist for example in Alang and there are some basic procedures for dealing with spills. In Bangladesh the stakeholders spoken to indicated that there were generally no procedures for handling spills and there were regular discharges of sludges, waste oils into the sea and burning of wastes takes place;
- Hazardous waste and non-hazardous waste storage does take place on the sites visited in Alang, but the feedback from stakeholders in Bangladesh indicated that there was no

separation or specific storage for hazardous or non-hazardous wastes and there were no dedicated waste management facilities;

- Selling on of wastes, including hazardous wastes, in India and Bangladesh to non-registered waste handlers and lack of control mechanisms in place to overcome this; and
- Anecdotal evidence derived from stakeholder conversations suggests that at Alang there have been some improvements in environmental, health and safety conditions as a result of international awareness and pressure for change. Also that international pressure is starting to initiate change in operating procedures in Bangladesh.

A number of other issues were also identified. These were:

- Workers receive some basic training in Alang, however it was not clear to what extent this includes health and safety training
- Monitoring of the health of workers takes place in Alang, but there is less focus on welfare issues. Health standards are generally low. Gastro-enteric and skin problems were cited as very common by the local Red Cross Association. From conversations with those operating the ship recycling yards it was indicated that levels of literacy were low in Alang and this was seen as the main constraint to improvement;
- At the yards Golder visited, there were no recorded problems associated with asbestos and no asbestos-related injury at the local Red Cross Association hospital. However, it was noted that there was no apparent monitoring of long term health;
- From conversations with ship recycling yard operators in Alang it was apparent that they were aware to some extent of the need to improve health and safety and to reduce the environmental impacts. However, they have to balance the costs of these improvements with the need to continue a profitable business in a highly competitive industry. The levels of literacy are low in Alang (reference conversations with most of the Alang based stakeholders, but particularly with those operating the ship recycling yards) and there are often many languages spoken by workers who are usually migrants, communication of training information needs to be pictorial and spoken word needs to in Hindi plus other languages.

5.3 Transitional Technology Options

5.3.1 Development of an Evaluation Matrix Long List

Based on the main issues identified from the site visits, literature review and the experience of the Golder team, a long list of issues was developed encompassing key environmental, as well as health and safety issues. For each issue, the hazards associated with these were identified and how these are currently responded to/dealt with based on our observation in Alang, stakeholder engagement and evidence derived from the literature review. By systematically going through each issue with the Defra team, a short list of key issues was developed which addressed the main gaps between current work practice and the new IMO Hong Kong Convention on Ship Recycling. The Long List is included in **Appendix 2**.

5.3.2 Short list

The merits and challenges of each issue included in the Long List were discussed in detail with the Defra team. From these discussions a short list for development into Guidance notes was agreed. The short list comprised:

- Spill prevention and clean-up procedures;
- Onsite storage of residues (oils/hydrocarbons, hazardous and non-hazardous wastes etc.);
- Working at height incorporating prevention of falls from height;
- Procedures for handling stored energy systems (including cable management);
- Hazardous Materials Identification and Inventories;
- Manual lifting; and
- Access incorporating confined spaces and illumination.

A reserve list was also drawn up should any of the short list be found to be already covered by other organisations:

- Environmental monitoring;
- Handling of gas cylinders and procedures for safe hot cutting; and
- Preparation of ship recycling plans.

The short-list was decided upon based on prioritisation in terms of the significance of the risk or hazard being reduced, and the likelihood and ease of up-take of the potential guidance.

5.4 Guidance Notes

Guidance Notes for each of the shortlisted key issues were developed in a format suitable for use as a basis for conversion into practical guidance documents and presentation to intergovernmental negotiating bodies. Such conversion was outside the scope of this project. With this in mind, they were written to be both applicable and appropriate (i.e. ease of up-take at the yards). The Guidance Notes are generally between 5 and 10 pages in length with the majority of the text describing the technologies/techniques/systems which would enable the reader of the eventual finalised guidance document to improve their current practice with this 'newer' way of doing their work. For example, the Spill Management note includes outline instructions on how to prevent a spill, what to do if there is a spill and how to clean it up.

Each Guidance Note includes a description of the issue, i.e. what risk or hazard the guidance note is aiming to reduce and why it's an issue. A technical description is provided of practical transitional technologies and solution, with details of plans and actions that can be undertaken to reduce the hazard/risk or improve the conditions associated with the issue. Indications of resource required implementing the solution, and likely costs are included where applicable and appropriate. Technologies and activities are described with the view of the notes being converted through further development into practical guidance documents.

Included in the Guidance Notes are suggestions on the envisaged format for the finalised guidance documents, the identification of possible barriers to implementation and proposals to overcome these, as well as advice on appropriate training to enable effective implementation.

The Guidance Notes developed during this project are included in **Appendix 3**.

A summary of the seven Guidance Notes is provided below:

- **Spill Prevention and Clean-Up Procedures**
  A drain down of all oils and fuels in pipes back to storage tanks is proposed for spill prevention, followed by flushing of tanks and pipework using heated water or jet spray. Collected oils and fuels would then be stored in accordance with the Onsite Storage of Residues Guidance Note. Provision of oil spill kits is proposed for dealing with spills. Materials normally freely available at ship recycling sites make up most of the solution, with the main cost involved in provision of water pumps and jet washers, expected to be in the range of $5,000.

- **Hazardous Materials Identification and Inventories**
  A checklist of hazardous materials, based on those identified in the Hong Kong Convention and utilising images of individual materials for ease of identification, is proposed. A survey of the incoming ship on arrival by trained workers using the checklist would be undertaken, following procedures for marking up and colour coding hazardous materials on the ship. Safe storage of removed hazardous materials would then be in accordance with the Onsite Storage of Residues Guidance Note. Apart from the small cost of developing the checklists the main change proposed is in training selected workers in identification and handling of hazardous materials.

- **Onsite Storage of Residues**
  The designation of an impermeable floored area away from dismantling operations for residue storage is proposed. The separation of materials within the storage area and clear signage around the area would be the main cost of this proposed solution, as existing materials available on-site are proposed for use as storage vessels e.g. used oil drums or ship's tanks would result in low storage costs. Specific storage arrangements for asbestos are proposed, including sealing in tarpaulin or plastic sheeting available on-site and wetting of asbestos whenever it is to be moved. Management of the storage area by selected workers and the provision of water and fire extinguishers would be the main cost, estimated at between $200 and $400.

- **Working at Height Incorporating Prevention of Falls From Height**
  As it is not possible to eliminate working at height it is proposed that risk is managed through a safe system of work, following ILO Guidance. Daily updating of the ship's General Arrangement diagram would highlight access routes clearly and a work plan would be used as reference before working at a height to identify danger areas. The cost of this solution would be low and it is therefore expected that uptake of the proposed solutions would be relatively easy for the ship yard operators.

- **Procedures for Handling Stored Energy Systems Including Cable Management**
  Reducing the risk from electrical and mechanical stored energy systems is relatively straightforward but requires qualified personnel. The proposed solution involves undertaking an inspection of the ship on arrival and a follow-up to release the stored energy where applicable. Cable management is more complicated and may be the most difficult to implement as damage is often from within and is inherently difficult to spot. The solution proposed involves an inspection regime and decrease in cable loads by use of a snatch block and, where appropriate, use of the practice of ‘end-to-ending’. The cost of qualified personnel for cable inspection is estimated to be in the range of $500 to $1,000. Expected costs of non-destructive test equipment are in the range of $3,000 to $6,000 per year and the cost of a snatch block fitted to a permanent structure in the region of $20,000. However, the ship recycling yard may be able to source some or all of the equipment required, thereby greatly reducing the cost.

- **Manual Lifting**
  This Guidance Note proposes alternatives to manual lifting using winch and tirfor arrangements and, where there is no alternative to manual lifting, safe practices. These safe practices involve only an awareness of the dangers and good practice when lifting and therefore can be implemented at minimal cost. The approach using a winch will require purchase of a suitable winch and rope, costing in the region of $1,500, though it is possible that one could be found onboard the ship. The option of utilising a tirfor and rope will cost approximately $950, with the possibility that a capstan could be found onboard the ship and dismantled to use for this purpose. Two solutions are proposed for large metal plate handling: the first utilising a loading machine and magnet. If a telescopic handler or other suitable loading machine is available the cost of this solution would be in the range of $6,000. The second proposes use of a ramp, a winch and tirfor and magnetic lifters. The cost of this solution would be in the range of $2,000 to $2,500.

- **Access Incorporating Confined Spaces and Illumination**
  In terms of illumination and when electric lighting is not available, this Guidance Note proposes a system of hole-cutting to allow in natural light and gives a safe procedure for this. A General Arrangement Plan is suggested as a method of clearly defining and communicating access and exit routes onboard the ship. An initial assessment on arrival of the ship’s confined spaces is proposed, combined with clear, picture-based warning signs. An entry permit scheme is then suggested in order to manage the risks involved in working in confined spaces, with air quality testing procedures outlined. The main cost involved in implementing these solutions would be connected to training, with the addition of an estimated cost of around $250 for oxygen test equipment. This solution should therefore be relatively straightforward to implement.

6.0 MAIN IMPLICATION OF FINDINGS

From the author's research and anecdotal stakeholder engagement, evidence suggests that recent improvements in environmental, health and safety procedures in India are being realised, and improvements are being initiated in Bangladesh. During our site visits to yards in Alang, we found that those who operate ship breaking and recycling yards are aware of the need to improve health and safety and reduce environmental impacts to some extent. However, it is a balancing act between the yard operators making an adequate profit on the ship recycling operations versus the costs involved in making improvements, in a competitive environment.

A key implication of the our findings is that step changes to improve the environmentally sound management systems at the ship recycling yards would be possible through the adoption of practical, appropriate and cost effective guidance.

It should be noted that the above results should be treated with some caution as the number of stakeholders engaged was limited due to people's availability and willingness to discuss the project, and the ship recycling yards visited was limited to Alang in India for health and safety reasons.

7.0 FURTHER DEVELOPMENTS AND ACTION RESULTING FROM THE RESEARCH

The Guidance Notes have been prepared so that they can be converted into practical guidance documents and presented to international negotiating bodies and implementing agencies.

References to published material

9. This section should be used to record links (hypertext links where possible) or references to other published material generated by, or relating to this project.

http://www.darcy.co.uk/upload/documents/1197974513_spill_kits_brochur8.pdf
http://www.marisec.org/resources/shiprecylingcode.pdf
http://www.ilo.org/public/english/protection/safework/cops/english/download/e000020.pdf
http://www.basel.int/pub/techguid/dismships/dismsh2003.pdf
http://www.shipbreakingplatform.com/dmdocuments/other_documents/com_2008_767.pdf
http://www.gmbports.org/alang_surkmht.htm
http://www.ilo.org/public/english/dialogue/sector/papers/shpbreak/wp-167.pdf
http://www.ban.org/
http://www.imo.org/includes/blastDataOnly.asp/data_id%3D24806/RecyclingofShips_12February2009_.pdf
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http://www.mpa.gov.sg/sites/circulars_and_notices/pdfs/shipping_circulars/sc08-20.pdf
http://www.ilo.org/public/english/dialogue/sector/papers/shpbreak/
http://ec.europa.eu/environment/waste/ships/pdf/ship_dismantling_report.pdf
http://www.ipen.org/ipepweb1/library/PCB%20Transformers.pdf
http://www.hse.gov.uk/pubns/indg143.pdf
http://www.ilo.org/public//english/standards/relm/gb/docs/gb289/pdf/meshs-1.pdf
http://www.basel.int/meetings/cop/cop8/docs/i21e.pdf
http://ec.europa.eu/environment/waste/ships/pdf/com_2008_767.pdf

APPENDICES

APPENDIX 1

QUESTIONNAIRE TEMPLATE

APPENDIX 1 - QUESTIONNAIRE TEMPLATE
Environmental Control
How do they deal with spillages
Are emissions to Air an issue? Such as dioxins, CFC's
Are emissions to Water an issue? Such as oil/HFO/PCB/mercury/sewage/solids
Are emissions to Land an issue? Such as through water waste accumulation/decomposition
IMO Compliance
What is a typical breaker's "pre-receival" process for vessels they are to break?
Do they know which regulations and legislations apply?
What audit process do they in place, if any, for the systems in place
What is the typical form of contract that the breaker has with the owner/broker?
What is the role of the broker/cash buyer?
At what point does ownership of the vessel actually transfer?
Who owns the beach/land on which the breaking occurs?
Pre-Arrival Preparations
Which steps are involved in preparing the vessel for beaching?
Do they deballast? Remove valuables? Drain the bilge tanks?
Are marine biological issues ever a concern?
Is marine growth ever a concern?
Is welfare provided for the workers, and if so, what?
Is there any special providence of baby/child welfare facilities?
Works Planning
Is the impact on fisheries and other nearby livelihoods taken into account?
How do they deal with cargo debris in the holds, and what contingency if debris contaminated?
How is the work organised? In Family Groups or Gangs?
How are they paid? By day or by production?
Are there teams that specialise? Or does everyone do any job?
What is the illiteracy rate?
What are the typical working hours?
Are the workers largely migrant workers and seasonal?
Are there any work orders/step-by-step processes adopted?
What equipment is typically used on site by the workers?
How is this equipment maintained?
How do they typically gain access to tanks and the holds? Who has the responsibility for this?
How do they communicate on the site? Same language or multiple?
Are there distinct Women/Men roles?
Are there any children working age limits?
Is there a work stage or task Stage between soft stripping and the commencement of cutting?
Waste Management
Where is the waste normally taken to?
Do they have any specific Hazardous Waste storage on site? Or off site?
What are the Resale markets like? Local, national and normally able to sell everything?
How do they handle the scrap, is that a separate dealer?
Do they burn the oil collected?
General Working Condition
What sort of temperatures do they work in?
What are the average Death Rates for the area
What are the main causes for accidents?
What is the average life expectancy for workers at these ship breaking yards?
What are the most common infections for the workers?

Decontamination/Making Safe
How is oil generally handled?
Are stored energy systems considered as potentially dangerous?
What do they do with the Heavy Fuel Oil Tanks? drain/store/sell?
Characterisation of wastes and materials onboard - is it done before works start?
Do they ever use booms to capture spilt oil? And if so, what happens to the oil?
Does any purging of the pipes occur?
What does typical PPE cost?
How do they handle asbestos
Are smoke detectors and other radiological items considered?
Is TBT considered (a contaminant in the paint)
Are PCBs considered?
Is mercury content (i.e. in thermostats) considered?
How do they extract oil from the tanks?
is the soot in the stacks considered?
Working Methods
Whilst hot cutting, do they take awareness of others around them?
How do they use gravity drops…with drop zones?
Do the cables sometimes snap during winching?
Do they have written or agreed Method Statements for some tasks?
What PPE is generally available?
Do they, and if so how, use cranes?
What sort of lighting is provided within the vessel?
Do they have any gas free procedures for working in tanks?
Do they consider Confined Spaces as hazardous?
Are there any Drinking and Smoking restrictions on site?
Are sex workers common near the site and is AIDS an issue?
Is violence an issue on site, or near site?
Where and how do they store the gas for use in hot cutting?

APPENDIX 2

LONG LIST OF PROPOSED OPTIONS

APPENDIX 2 - LONG LIST OF PROPOSED OPTIONS				
Issue	**Finding from Site Visit (India)**	**Hazard**	**Dealt with by others?**	**Recommended for Development**
Environmental Control				
How do they deal with spillages	Usually tanks come in drained however when there are spills there is manual soaking with sand and then packaging and disposal to GEPIL (haz waste facility) - bilge tanks and slop is scooped out in a crude man made scoop made of different sizes	Environmental Spill		Yes as Spill Mitigation and Cleanup Procedures
Are emissions to Air an issue? Such as dioxins, CFC's	No regulations except monitoring half yearly and P.P.E	Environmental contamination		
Are emissions to Water an issue? Such as oil/HFO/PCB/mercury/sewage/solids	No regulations except monitoring half yearly and P.P.E	Environmental contamination		
Are emissions to Land an issue? Such as through water waste accumulation/decomposition	No regulations except monitoring half yearly and P.P.E	Environmental contamination		
IMO Compliance				
What is a typical breaker's "pre-receival" process for vessels they are to break?	List of documents and procedures with customs and regulatory authorities to complete. Demo in case its the first time.	Unknown hazardous materials - uncontrolled		Yes: simple templates for Ship Recycling Plans which can be adopted
Do they know which regulations and legislations apply?	Yes informed by cash buyer	N/A		
What audit process do they have in place, if any, for the systems in place	Regular checks by various authorities on systems especially Gujarat Maritime Board and Gujarat pollution control board, NB easily bribeable	N/A		Possible: Support to the enforcement as regards helping them regulate with some simple templates?
What is the typical form of contract that the breaker has with the owner/broker?	Middle man - no interaction with the owner (Broker carries out all transactions)	Unspecified requirements leading to limited enforcement		Possible wrt reviewing current "SALESCRAP" to identify areas that can be amended to reflect IMO/EMS
What is the role of the broker/cash buyer?	Money transaction and legal handover carried out through cash buyer	N/A		
At what point does ownership of the vessel actually transfer?	Once money is transferred and customs is cleared	N/A		
Who owns the beach/land on which the breaking occurs?	GMB	N/A		
Pre-Arrival Preparations				
Which steps are involved in preparing the vessel for beaching?	Guidance to captain / radio is broken/ explosives are removed and CO_2 system is deactivated	N/A		

APPENDIX 2 - LONG LIST OF PROPOSED OPTIONS				
Issue	**Finding from Site Visit (India)**	**Hazard**	**Dealt with by others?**	**Recommended for Development**
Do they deballast? remove valuables? Drain the bilge tanks?	Deballasting is done at Alang, valuables and bilge tank drained	N/A		
Are marine biological issues ever a concern?	Not an issue as reported	Marine Environmental		
Is marine growth ever a concern?	Not an issue as reported	Marine Environmental		
Is welfare provided for the workers, and if so, what?	Training and welfare programs like aids awareness other medical assistance through red cross, NB malnutrition is an issue amongst workers	Personal Hygiene	SAFEREC/ILO	
Is there any special providence of baby/child welfare facilities?	Immunisation programs and doctors to attend through the mobile hospital	Personal Hygiene		
Works Planning				
Is the impact on fisheries and other nearby livelihoods taken into account?	None noted/ no complaints issued.	Marine contamination	UNESCO	
How do they deal with cargo debris in the holds, and what contingency if debris contaminated?	Cleaned and swept holds prior to beaching - needed for custom clearance	Marine contamination		
How is the work organised? In Family Groups or Gangs?	Organised by the mukadam (head henchman) who recruits these workers from other states e.g. Bihar, UP and Orissa	N/A		
How are they paid? By day or by production?	Paid on daily wages which fluctuate based on demand however the minimum is set as 150 RS (3 USD)/ daily	N/A		
Are there teams that specialise? Or does everyone do any job?	yes as helpers, cutters, mukadams and safety personal (2 permanent staff one for land and one for the ship compulsory)	N/A		
What is the illiteracy rate?	Not known - a finding is signs are mostly in local language (Hindi) however pictorial messages on safety should be increased. It is understood that the National Commission for Enterprise of the Unorganised Sector completed study recently, though results not yet available.	N/A		
What are the typical working hours?	7am to 7 pm (range of hours however they work for only 8 hours)	N/A		
Are the workers largely migrant workers / seasonal workers / from local population ?	Mostly migrant workers from neighbouring states - stay in town for an approx 10 months /yr	N/A		
Are there any work orders/step-by-step processes adopted?	Yes work orders sent down by the mukadam	No Safe Systems of Work ??	Possibly SAFEREC/ILO	Yes for specific high risk activities

APPENDIX 2 - LONG LIST OF PROPOSED OPTIONS				
Issue	**Finding from Site Visit (India)**	**Hazard**	**Dealt with by others?**	**Recommended for Development**
What equipment is typically used on site by the workers?	Isi cutters/cranes/water pumps(mandatory), blocks pulleys	Safe Systems of Work??	SAFEREC/ILO	
How is this equipment maintained?	Through regular inspection from GMB Reps	N/A		
How do they typically gain access to tanks and the holds? Who has the responsibility for this?	O_2 meters by the authorised confined space personnel and safety inspector to certify safety of tanks and holds	Safety		
How do they communicate on the site? Same language or multiple?	Mobile phones - same language Hindi, NB migrant workers do not necessarily speak Hindi (language of the educated)	N/A		
What is the ratio of men/women/children typically working?	25 women for every 1,000 men (no women on site) senior ranks have families living in the nearby colonies	N/A		
Are there distinct Women/Men roles?		N/A		
Are there any children working age limits? What roles do young people take if working (under 16s)	Min age (mandatory) 18 no child labour	N/A		
Is there a work stage or task Stage between soft stripping and the commencement of cutting?	Scrapping of paint to prevent any metal fumes during cutting activity	Hazard to Health		Yes: Preparatory for hot cutting
Is there any health and safety training?	All workers go through basic safety training and role specific training based on task then are issued a card based on which the ship breaker can hire - refresher courses also held	True for all??		
Waste Management				
Where is the waste normally taken to?	GEPIL - About 1 km away from the site (designated waste handling facility managed by GMB)	True for all??		Yes: for hazardous waste disposal - minimum requirements
Do they have any specific Hazardous Waste storage on site? Or off site?	Yes all plots have specific stores for haz waste and non haz waste which is quantified and sent depending on state in sealed bags in trolleys and payment is made either per kg or litre once the hold in house is full	True for all??		
What are the Resale markets like? Local, national and are they normally able to sell everything?	Makeshift resale market stretching approx 5 kms beyond the plots and sell everything second hand from the ship - ranging from wood, kitchen products and consumables.	N/A		
How do they handle the scrap, Is that a separate dealer?	All is supposed to be sent to GEPIL if hazardous however if reusable then it is sold to one main dealer who sorts and resells everything to the second hand market located on the main road towards Alang	N/A		
Do they burn the oil collected?	No it is sold	True for all??		

APPENDIX 2 - LONG LIST OF PROPOSED OPTIONS				
Issue	**Finding from Site Visit (India)**	**Hazard**	**Dealt with by others?**	**Recommended for Development**
General Working Condition				
What sort of temperatures do they work in?	April - June temperatures soar to 45 degrees cent. Otherwise 30 - 38 degrees - cutters exposed to extreme temperatures.	N/A		

APPENDIX 3

TECHNICAL GUIDANCE NOTES

APPENDIX 3-1

TECHNICAL GUIDANCE NOTE ON

SPILL PREVENTION AND CLEAN-UP PROCEDURES

APPENDIX 3-1

TABLE OF CONTENTS

1.0 SUBJECT OF GUIDANCE NOTE

1.1 Description of Issue

It is understood that some of the ships arriving at ship recycling yards still contain numerous hazardous substances including liquids such as residual fuels and slops, these being normal to the operations of the ships. During ship recycling however, these residual liquids can sometimes be accidentally spilt onto the beach or directly into inshore waters, causing marine and beach contamination.

The main issue with residual liquids concerns fuels remaining on the ships, where the larger ships are typically powered using heavy fuel oil. Some ships (including cruise ships) will run on Gas oil, which can, along with diesel, also be used to power small generators etc. on ships.

Slops such as the ship's grey water and sewage are also regular sources of liquid residues found on ships.

Even if the majority of these liquids may be discharged before beaching, there will often be some residual liquids in the ship's tanks, pipes and storage containers. It is the spillage of these residual liquids onto either the beach or into the inshore waters during the recycling activities which can cause contamination of ground and marine waters.

1.2 Justification

Marine contamination from the residual liquids can have a significantly negative impact on the local economy, including damage to the fishing stock both in terms of quantity and quality of fish available. With ingestion of the contamination by fish, the total quantity of fish available as a local food source can be reduced. Field visits to yards in Bangladesh found anecdotal evidence from fishermen that over 30 species of fish were no longer found in the seas near the ship recycling yard[1]. In addition, contaminated fish will be caught locally and ingested by the local population, leading to human health risks.

Under certain conditions, spilt hydrocarbon contamination (i.e. heavy fuel oils and gas oil) onto the beach and land can present a fire hazard. A build up of ground contamination coupled with the presence of gas cutting equipment with smouldering metals and high temperature flames could result in a major fire at the sites where hydrocarbons have been spilt over time.

1.3 Findings from Research

From local research and desk-based studies, it is clear that the predominant remaining liquid residues on a typical ship for recycling are from heavy fuel oil present in the fuel tanks of

[1] Stakeholder Engagement, Bangladesh, April 2009

ships. These are routinely spilt during the recycling operations, whereas in recycling yards with impermeable working surfaces, such spillages can be easily managed and cleaned up. However, where the working surface is permeable, i.e. on a beach, spillages are typically not managed and thus have the risk of causing contamination to the marine and land receptors.

It is believed that oils are manually removed by operatives at some recycling yards[2]. During these works, there is limited evidence as to any specific procedures or precautions adopted to prevent spills, or manage these spills should they occur.

1.4 Aim of the Proposed Solution

The aim is to advise on simple methods for preventing spills from ships undergoing recycling at yards in Pakistan, India and Bangladesh and propose straightforward ways in which to manage spills, should they occur

2.0 TRANSITIONAL TECHNOLOGY SOLUTION

2.1 Technical Description

2.1.1 Removal of Residual Liquids

A proper and thorough removal of all liquids from within the ship prior to the commencement of recycling activities would negate the requirement for spill prevention and management. However, in practice this is not achievable as there will always be some residues remaining in pipe bends, at the bottom of tanks and in systems that are required right up until the beaching of ships at the recycling yards.

During the preparations of a ship for recycling, the oils and fuels within the pipe work of a ships systems should be permitted to drain under gravity back to the storage tanks. This drain down can take anything between 12 hours to several days depending on the ambient temperature, size and nature of system being drained and viscosity of the liquids being drained. This will require adjustments being made to the arrangement of the valves and opening of the vents to enable the hydrocarbons to move back to the tanks, such adjustments including creating openings in the pipework to create better flow.

[2] Evidence shown in documentary film Eisenfresser (Iron Eaters) by Shaheen Dill Riaz, 2007

The storage tanks containing hydrocarbons should then be emptied by bottoming out, which is proposed by the following drain down sequence:

1. Using existing taps, valves or drain points, allow the oils to drain under gravity directly into appropriate containers placed under the tanks being bottomed out;
2. If the drain point is too high for all the contents of the tank to be removed, then use a hose and hand/air pumps to pump out the liquid. The hose should be placed through a high level opening or access point and then the liquid pumped directly into a suitable container;
3. Once the liquids have been removed from the tank, there may be some residual sludge within the tank that also needs to be removed prior to recycling activities starting. Where possible, this sludge should be made more mobile by agitation, which can be done manually, after which the sludge can be pumped out using a hose and hand/air pumps; and
4. If there is still some residual sludge remaining within the tank, this may require manual removal by excavating the material out of the tank. This type of work which requires access to confined spaces, must be undertaken under the appropriate control mechanisms. Further guidance on accessing such tanks is given in the 'Access incorporating confined spaces and illumination' Guidance Note (**Appendix 3-7**).

Once drained of their oils and contents, it is recommended that the tanks and pipework should be flushed or jet washed (dependent on access) to remove residual deposits.

Such flushing can include forcing hot water through the system to remove the majority of the deposits and residues. For more stubborn substances, a cleaning product can be used where such would be readily available for this purpose from local tank cleaning suppliers. Cleaning products would typically be added to water (where sea water would suffice) in typical concentrations of 1 part cleaning product to 10 to 20 parts water.

The washings resulting from such cleaning will need to be collected into suitable containers once flushed through the pipes and tanks. This can be undertaken in the same manner as detailed in the hierarchy of tank draining detailed above i.e. the pipework be flushed through before allowing draining down into the tank. This will require the use of pumping equipment to supply water (or sea water).

The washings collected from the cleaning process should be allowed to settle out in the containers, letting the water separate out from the hydrocarbons. Once this water has been removed from the containers, the hydrocarbons should be stored and then disposed of in accordance with the 'Onsite storage of residues' guidance note.

Once the tank has been drained of the liquid and sludges and the wash step completed, the tank should be left open and marked 'drained and flushed of liquids' or similar. A simple sign could also be made at site to convey this message. At the drain points of the tanks, drip trays should be left under these to collect any remaining residuals still dripping from the tank.

2.1.2 Spill Prevention

During the process of draining down the ship's system and whilst transferring the liquids collected from the system to their suitable containers, there is a high risk of spillage. Measures should be put in place to reduce the risk of any spillage having an adverse environmental or health impact (i.e. via the sea or the ground). The easiest way to prevent a spill from causing pollution is to put a further barrier between the liquid and the receptor.

A common barrier used is a 'bund', i.e. a raised object that retains the liquid within a specific area, allowing it to be retrieved in a controlled manner. These are typically placed on the ground underneath the area of work, fully encapsulating any potential spillage.

Such bunds can either be bought as mobile (often inflatable) bunds or made onsite at the recycling yards using available materials. Examples of how such bunds can be made on site include:

- Plastic sheeting can be laid out underneath the working area where the sheeting is supported on a timber frame at its edges. The sheeting should be wrapped up over the timbers to create a raised barrier to liquids escaping the area;
- Using a tank from the ship, cut the bottom out with an excess of 100mm of the tank sides to provide a tray which can be placed under any work incorporating residual liquids;
- Using former life boats from the ships, which can be used to capture any residuals, noting that minor alterations may be required to seal up any outlets within the lifeboat; and
- Using the bottom of an IBC (intermediate bulk container), create a tray of varying depths to capture and potentially store (for settlement purposes) the residual liquids.

2.1.3 Spillage Response Measures

Immediate response to a spillage is required under any spill response plan and for this purpose it is proposed that 'oil spill kits' should be provided. These would be available from local spill management suppliers or could be created on site prior to works commencing.

An oil spill kit will typically comprise the following items:

- Spill contaminant socks (e.g. rolled up recovered carpets / bedding);
- Absorbent mats (e.g. carpet, bedding, curtains);
- Absorbent material (e.g. saw dust or other similar materials);
- Rolls of absorbent material (e.g. rags or similar discarded material);
- Disposal bags for the collection of the absorbent materials containing the spilled liquid;
- Personal safety equipment (safety glasses, gloves, overalls etc); and
- A storage box/container for the onsite storage of the oil spill kit.

The spill kits should be stored centrally on the ship allowing for easy access during the recycling works. The work teams can then bring smaller quantities of the oil spill kit components to their workface during the actual work, allowing for quicker application in the event of a spill.

2.2 Resource Requirements

For the prevention of spills, the foremost resource requirement is additional time for workers to inspect the ship for residual liquids and subsequently drain and/or flush any residuals found to ensure that the ship is totally clean prior to the commencement of ship recycling. This resource will be predominantly labour cost and may also include minor costs for the production of simple signs to identify pipes and tanks which are either clean or containing residues. These signs can be made (painted) onsite using locally available materials.

For the removal of residues from the pipes and tanks, the equipment required to pump out the liquids, subsequent purging of the pipes with jet washers and cleaning down of the tanks will cost in the region of $5,000 depending on the capacity of pumps and quantity of cleaning materials required. It is anticipated that the majority of this equipment can be sourced locally.

For the clean-up of spills, the spill kits are expected to be developed onsite since the basic materials are locally available. A cost of between $500 to $1,500 can be expected for the creation of a spill kit, where this can be lower should materials for the spill kit be sourced from the ships being recycled at the yard.

All of the materials (except for items of equipment such as pumps) bought for the purpose of spill prevention and management will need to be replenished as stocks decrease with use.

It is anticipated that most of the unskilled workers currently employed at the ship recycling yards can be trained in the undertaking of most of the activities identified in this guidance note (excluding confined space entry which require specific training). A spill response team could be devised, which does not have to be a standalone team but could be a selection of workers that are trained and called-in to deal with a spill.

3.0 IMPLEMENTATION OF SOLUTION

The proposed solutions provided in this guidance note will require further work to develop into full guidance documentation to the benefit of the ship recycling operators and workers.

As such, the following section offers recommendations on how the guidance could be implemented by the operators and workers.

3.1 Proposed Format for the Guidance Documents

We envisage that the guidance proposed for spill prevention and management is largely pictorial in format encompassing the following main themes:

- The removal of residual liquids by draining down, bottoming out of tanks and purging/cleaning of pipes and tanks, also incorporating suggested designs for signs to be used;
- The laying out of spill capture materials and equipment prior to and during the removal of residual liquids; and
- The clean-up of any spillages.

In addition, a checklist can be developed of actions to go through for the identification of pipes and tanks which may contain residual liquids, what to have in place before and during the removal of residual liquids and what equipment and resources to have in place for actual clean-up of the spills. This checklist can include photos and drawings of actual equipment required for each of the items in the checklist.

3.2 Barriers to Implementation

The barriers should be relatively easy to overcome as they are expected to be the cost of introducing an additional system and work package as part of the ship recycling process, as well as an additional cost to the current work practice.

The yard might have to incur costs in both purchasing the materials and equipment proposed, as well as using worker time to prevent and manage spills. The income from the sale of recovered oils may help offset these costs .

3.3 Overcoming Barriers to Implementation

A two pronged approach to overcoming the barrier of implementing the proposed guidance on spill prevention and management is suggested:

- Awareness, by highlighting to the ship owners the potential negative environmental and human health impact current ship recycling practice has in some recycling yards, and the opportunity these owners have in supporting a transitional change in reducing risks to the environment and human health. These opportunities include acceptance that improved working practices at the yards incurs additional costs to the recycling of their ships and so reduce profitability. An understanding for this will enable the ship recycling operators to include for these additional costs in their bidding for the ships; and
- Support to the ship recycling yard operators and contractors in the adoption of transitional steps in their working methods for spill prevention and management, i.e. through the development of guidance documentation as well as the providence of training in the guidance. In adopting these step changes, they should be encouraged to quantify the additional costs in materials, equipment and workers with the purpose of

informing the ship owners / brokers of how they have included these improvements in their proposed recycling of the ship.

3.4 Proposed Training Schemes

It is anticipated that there would be two parts to the training arising from this guidance note:

- Firstly an introductory training of the guidance documentation on spill prevention and management to ship recycling yards highlighting both the technical aspects of the guidance as well as the benefits which can be realised through adoption of the guidance. This would be largely geared towards the ship recycling operators themselves to encourage take up of the principles of the spill prevention and management; and
- Secondly, training geared directly towards the contractors and workers at the ship recycling yards on specific technical details of the guidance documentation. Regular refresher courses on the guidance should be included for, say on an annual basis.

APPENDIX 3-2

TECHNICAL GUIDANCE NOTE ON

HAZARDOUS MATERIALS IDENTIFICATION

APPENDIX 3-2
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APPENDIX 3-2 LIST OF TABLES

1.0 SUBJECT OF GUIDANCE NOTE

1.1 Description of Issue

Currently the numerous hazardous materials and wastes often found on a ship are not typically identified prior to recycling works commencing. Subsequently, these hazardous materials and wastes can pose a risk to the workers at the recycling yards, as well as the surrounding environment.

The Hong Kong Convention defines hazardous materials as “materials posing harm to human health or the environment.” These include the following materials typically found on ships being sent for recycling:

- Fuel, lubricants, and coolants;
- Materials possibly containing PCBs such as wiring insulation;
- Harmful aquatic organisms in ballast water; and
- Asbestos.

The key issue is that these materials and wastes can often occur in large quantities on the ships, and not have been suitably reported to the ship recycling operators by the ship owners/agents. Furthermore, these hazardous materials and wastes can be located in parts of the ship which are either difficult to access or embedded within the building fabric of the ship, making both their identification and removal difficult.

1.2 Justification

Unless specifically trained to identify and quantify these types of materials and wastes, workers on the ships may not realise the hazardousness of the materials they are handling, exposing themselves and the surrounding environment to potential risks.

Learning how to identify and subsequently manage these hazardous materials and wastes would help prevent environmental and health & safety incidents during the recycling operations. This knowledge would support a pre-emptive approach to risk reduction at the ship recycling yards.

1.3 Findings from Research

Research from the desk study and site visits indicate that while ship recycling yards give consideration to the presence of oils and asbestos, and surveys or inspections are sometimes carried out prior to beaching, it is unusual for a ship to have a full Inventory of Hazardous Materials (IHM).

From Golder’s observations at the ship recycling yards in India, facilities for the abatement of asbestos are present at site, though it appeared on the basis of this brief visit that these were not always used. In addition, according to the Gujarat Maritime Board, some training on hazardous materials is carried out,

1.4 Aim of the Proposed Solution

The aim is to reduce the risk to human health and the environment by enabling workers to identify any hazardous materials and wastes on ships, thus aiding the appropriate management of these materials during the recycling works.

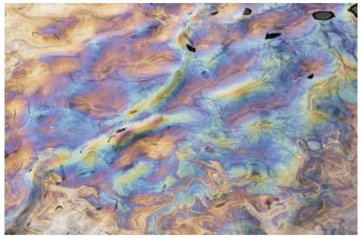
2.0 TRANSITIONAL TECHNOLOGY SOLUTION

2.1 Technical Description

The text from the Hong Kong Convention on the safe and environmentally sound recycling of ships provides a list of Hazardous Materials with their likely location on ships. This list could be developed into a checklist, with pictures of the individual materials, for use by the workers on the arrival of the ship to the recycling yard. Thus, a survey could be undertaken by trained workers using the checklist and pictorial guides to identify and quantify the hazardous materials. These materials could then be marked up and colour coded to clearly identify where hazardous materials are located. All workers should have basic training on how to deal with these materials and materials should be stored in line with the Onsite Storage of Residues Guidance Note (**Appendix 3-3**).

An example of a possible checklist can be found below in **Table 2-1**. The checklist is unlikely to be able to cover all hazardous materials that might be found and so should concentrate on the most common and most harmful.

Table 2-1: Hazardous Material Checklist Example

Substance	Picture	How marked	Possible Location
Asbestos		Red 'A' could be marked on all potential ACM	Asbestos-containing material (ACM) may be found in thermal system insulation and on surfacing materials. Engine rooms usually contain the most asbestos. Other applications can include gaskets in pipework, insulation board, vinyl tiles and surface coatings.
Oils/fuel oil/hydraulic oils		Tanks containing oil could be marked on the outside of the ship and at the tank entrance.	The vessel's piping and tank arrangements will generally contain some quantities of oil, fuel, sludge and associated residues. Fuel oil may be found in both integrated and free-standing tanks throughout the ship. Lubricating oils may be found in a variety of tanks depending on their individual use.
Bilge and Ballast water		Tanks and voids containing Bilge and Ballast water could be marked outside the ship and at the tank entrance.	Bilge water is stagnant water mixed with potentially polluting liquids, which has drained to the lowest inner part of a ship's hull (i.e. the ship's bilge). Bilge water may be found anywhere in the ship, and its quantity increases during dismantling activities due to the accumulation of rainwater as well as cooling and containment water used during dismantling operations. Ballast water is fresh, brackish or marine water that has intentionally been brought on board a ship in order to adjust the ship's stability and trim characteristics in accordance with various operating conditions.

Some substances such as PCBs cannot be visually identified. If no information is available from the ship owners, assumptions should be made based on age of the vessel, where it was built and materials on board.

2.2 Resource Requirements

The main resource requirement for the identification and quantification of hazardous materials and wastes on a ship destined for recycling is labour. Thus a selected number of workers at the recycling yard could be trained to carry out these surveys on arrival of the ship at the yard. In addition, all workers would need awareness training to explain what materials have been marked as hazardous and what to do with them. This awareness-raising could involve 5 hours of on-site training spread across a number of days to minimise disruption. The process would involve a person already trained in recognising hazardous material onboard ships taking designated workers to points on the ship were each of the hazardous materials are regularly found. In this way workers will learn the different forms of the material and how it appears onboard ships.

An additional resource requirement would be paints for the labelling of hazardous materials identified. Paints available in the local market could be used for this, resulting in minimal expense.

2.3 Risk to Human Health and Environment

Table 2-2: Summary of Risks to Human Health and the Environment

Materials and Hazards			
Potentially Hazardous Material	**Hazard**	**Threat to workforce**	**Threat to the Environment**
Oils and fuel	• Hydrocarbons • Sludge • Heavy metals • Explosive • Vapours	Highly refined petroleum products are toxic and also represent a fire and explosion hazard. Toxic hazards may impose serious health threats to workers if handled incorrectly. Main exposure routes are inhalation and consumption of contaminated fish and water.	Oils and fuels may poison marine organisms and physically impact the environment (birds, fish, plants, etc.). Oil spills also threaten natural resources.
Bilge and ballast water	• Oil and grease • Residual fuel • Petroleum hydrocarbons • Biocides • Heavy and	Ballast water may carry pathogenic organisms which threaten human health. Bilge water can be the	Threat to local and regional biodiversity may have severe economic consequences. Introduction of non-indigenous species disturbs the ecological

Materials and Hazards			
	other metals • Non-indigenous organisms	carrier of viruses and bacteria harmful to humans.	balance. Oil, petroleum, hydrocarbons, biocides and certain metals can have toxic effect on the external environment Oil causes physical damage to the external environment
Cargo residues	• Chemicals • Oils • Gases	Potential fire and explosive hazards	Chemicals, petroleum/non-petroleum oils can have adverse effects on the environment.
Asbestos	Asbestos fibres	Inhalation of high levels of asbestos fibres can lead to increased risk of lung cancer, mesothelioma and asbestosis	

3.0 IMPLEMENTATION OF SOLUTION

The proposed solutions provided in this guidance note will require further work to develop into full guidance documentation to the benefit of the ship recycling operators and workers.

As such, the following section offers recommendations on how the guidance could be implemented by the operators and workers.

3.1 Proposed Format for the Guidance Documents

We would envisage that the guidance documentation resulting from this note should include a checklist, with pictures, for all commonly found hazardous materials, with guidance on how to label them as hazardous materials.

This checklist can then be used in the training of surveyors at the ship recycling yards, where such training incorporates the visual identification and quantification of these materials. Furthermore, a separate training package can be developed as awareness raising for the ship recycling workers to be informed on what the various labels mean and what risks these materials pose.

3.2 Barriers to Implementation

The barriers are not high but are likely to include language since numerous languages are spoken at the ship recycling yards and communicating the labelling and risks posed by each material can be challenging. Furthermore, explaining risks of effects which cannot always be seen is difficult.

The time taken to conduct the surveys once beached and before recycling commences will impact on the schedule of the recycling works and may therefore be seen as a delaying factor to the works.

3.3 Overcoming Barriers to Implementation

Ideally, ship owners should be encouraged to have developed IHM's for their ships destined for recycling at the yards in India, Bangladesh and Pakistan, where these IHMs are then handed over to the ship recycler at award of contract.

However, appreciating this is currently not the norm, the dissemination and uptake of the guidance is required through use of pictorial checklists and associated training materials in multilingual text as appropriate to the yard.

Most of the educational efforts need to be aimed at the medium and long term effects of hazardous materials, such as asbestos and PCBs on human health and the environment (fisheries etc), so that the workers are aware of the risks.

3.4 Proposed Training Schemes

Each recycling yard should have a specially trained team to survey for hazardous materials onboard every ship that arrives. All workers will receive training on what the labelling on the individual material means, and how to deal with these materials.

Samples of hazardous materials should be available (in a safe manner) for workers to familiarise themselves with.

The training should be given to all workers when they start. Regular toolbox talks[1] should be given, which should be practical and show hands on methods which could be employed. Topics could be suggested by workers or based on any incidents which have occurred. If a ship arriving is known to have a particular hazard, i.e. a considerable amount of one less usual material, a toolbox talk on this should be arranged prior to recycling works commencing.

[1] On-site, brief, training using visual and practical techniques

APPENDIX 3-3

TECHNICAL GUIDANCE NOTE ON

ON-SITE STORAGE OF RESIDUALS

APPENDIX 3-3
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APPENDIX 3-3 LIST OF TABLES

1.0 SUBJECT OF GUIDANCE NOTE

1.1 Description of Issue

The main hazardous material found on ships for recycling is asbestos, due to its widespread use from lagging of pipes to use as an adhesive material. An additional major hazard arises from fuel and lubricating oils, which can be found throughout vessels both in integrated systems, for example in engine sump tanks, or in free-standing containers, for example oil drums.

Other materials which present a potential challenge onboard ships are contained in bilge and ballast waters. Substances which at first hand are typically not identified can thus pose a greater threat to the workforce or environment than they might at first appear.

This note aims to identify the main hazardous materials of concern and propose ways in which these can be stored onsite until final reuse, treatment of disposal.

1.2 Justification

Assessments of ship recycling sites frequently show high concentrations of oil in water and sediments in soil samples[1]. Asbestos may be found in considerable amounts onboard ships sent for dismantling[2]. These findings support the claim of environmental contamination caused by ship recycling activities. The European Commission estimates that an average of 400,000 to 1.3 million tonnes of toxic materials on board end-of-life vessels, including up to 3,000 tonnes of asbestos, is exported each year for recycling to developing countries from the EU[3].

1.3 Findings from Research

From a desk-based study and reference to local research, it is evident that oil and sludge from ballast tanks is not often stored on site but is discharged to the sea. Furthermore, burning of oils from tanks occurs, resulting in danger to workers in terms of toxic fumes and damage to the sea and air environment. Anecdotal evidence from site visits to Bangladesh indicates that there has been a large loss of local fish species over recent decades affecting local fishing community livelihoods. Ballast water can potentially contain viruses and bacteria, which might cause illness in humans and damage to local ecosystems if not properly managed.

[1] European Commission Directorate General Environment: Ship Dismantling and Pre-Cleaning of Ships (June 2007)
[2] Worker Safety in the Ship-Breaking Industry. A. B. Anderson, ILO. Feb 2001. Section 4.2.1.6
[3] European Commission: Impact Assessment for an EU Strategy for better Ship Dismantling, SEC(2008)2846

Normal practice at ship recycling sites[4] does not as a rule include procedures for the on-site storage of residues, such as oils and fuels, or asbestos. Asbestos handling and storage is therefore a major area of concern. Results of a questionnaire undertaken at sites in Bangladesh show that asbestos is not recognised as hazardous to health, with workers breaking asbestos sheets by hand and asbestos insulated pipes being sold on the open market as scrap. Oils and fuels not discharged to the sea can lead to a dangerous flammable atmosphere during hot cutting.

1.4 Aim of the Proposed Solution

The solutions highlighted aim to provide a transitional-technology for safe storage and monitoring technique which can be used by a single ship recycling location or group of close locations. Following only a small amount of training, workers will be able to take the required precautions to implement safe storage of hazardous materials and to ensure no leakage or ongoing contamination of the ship recycling site following storage. The aim is therefore to improve current practices at ship recycling sites. In the case of asbestos, however, incremental improvements in current practice are not considered appropriate as the effects of mishandling asbestos on human health are serious and long-term. This note therefore aims to provide a locally appropriate but more rigorous approach to raising awareness and improving storage of asbestos and asbestos containing materials.

2.0 TRANSITIONAL TECHNOLOGY SOLUTION

2.1 Technical Description

2.1.1 Identification of Materials on-board Ship

Some hazards can be reduced, or even eliminated, by the safe handling and storage of materials and through the raised awareness of ship workers. The key to this is initial identification of hazardous materials before any work starts on ship dismantling. This area is covered in Guidance Note: Hazardous Material Identification and Inventories (**Appendix 3-2**).

2.1.2 Storage of Materials

The following table gives guidelines which, if followed, would lead to safer storage of hazardous materials. This is important in raising awareness of the hazards present on a ship recycling site.

[4] Evidence shown in ILO documentary film: "Shipbreaking, what can be done?"

Table 2-1: Safe Storage of Hazardous Materials

Potentially Hazardous Material	Storage Guideline
Oils and fuel	Used oil should not be mixed with other wastes as this may require the entire amount being managed as hazardous waste. Used oil should be stored in dedicated tanks or containers and should be labelled “Used Oil”. Oil and fuel which have been removed from a ship must be stored in a safe tank arrangement, ensuring leakage detection, overfill monitoring and corrosion protection. The most environmentally friendly and often most economical way of managing used oil is recycling. Oil and oily wastes that are defined as hazardous waste, either by appearing on a relevant hazardous waste list or by having hazardous waste characteristics (ignitable, corrosive, reactive or toxic), should be managed according to governing national hazardous waste regulations where appropriate.
Bilge and ballast water	Bilge and ballast water may safely be transferred to onshore storage tanks or evaporation pits (ballast water only). Regulations apply that specify permitted levels of contaminants. Note that the MARPOL convention, Annex I, also provides regulations for permissible levels of oil in discharged ballast water. Sometimes the facility may have to reduce the pollutant content in wastewater prior to discharge in order to meet national regulations, should this be applicable.
Asbestos (and asbestos containing materials ACM)	Asbestos is a hazardous waste as designated by the Basel Convention and therefore re-use or recycling should be avoided. The potential health impacts associated with the use of asbestos are of such a severe nature that maximum precautions are necessary. This includes both the protection of workers when extracting asbestos from the vessel, the securing of the disposal of asbestos and measures preventing asbestos from re-entering the market. An asbestos management plan should include requirements associated with the ship’s inventory plans so that asbestos can be localised, quantified and identified prior to removal. The asbestos management plan should identify protective clothing required for personnel removing the material and procedures for both the removal as well as the disposal. Local regulations should determine the degree of exposure permitted. If they do not, then international guidelines will need to be referred to. The facility is strongly advised to refrain from selling asbestos for market re-entry. It is essential to keep the asbestos wet before and during the removal operations in order to avoid dispersion of the fine fibres in the air. Asbestos removal should always be carried out with two people: one who makes sure the asbestos is wet during the removal operation and one performing the actual asbestos removal work. Asbestos removal should be carried out only by workers who have been specially

	trained to do this type of work. In cases where there are several ship dismantling yards in one area these specialised workers could be shared by the dismantling companies. Workers involved in asbestos removal and disposal must use appropriate respirators, as well as protective clothing such as overalls, head coverings, gloves, face shield or vented goggles, and foot covering. The facility should be encouraged to provide hygiene facilities for workers, such as decontamination areas (equipment room, shower area and clean room) and dining areas. If a ship's inventory containing the details on asbestos is not available, a survey of asbestos containing materials on the ship must be carried out. The inspection should include determination of location, type and amount of ACM (localise, identify and quantify). Instead of collecting samples for asbestos analysis, it might be feasible to assume that all suspect material is ACM. All ACM must be removed from a ship being scrapped before any activity that would disturb the materials is carried out. Properly labelled leak-tight containers with lids are required for the transport of asbestos from the extraction site to the disposal area. Typically, asbestos is disposed of in sealed containers in landfills. Alternatively, a cement lined pit can be constructed and capped. It would also be recommended that the location be identified and labelled

2.1.3 Onsite Storage of Residues

2.1.3.1 Storage Area

Materials, both hazardous and non-hazardous, are typically collected from the ship before dismantling operations begin, and brought to shore for temporary storage prior to sales and/or further treatment. An area away from dismantling operations should be selected for storage use. This area should be divided into separate sectors for different types of waste materials and different types of waste should not be mixed.

The following is general guidance on the storage facility:

- The storage area should be equipped with an impermeable floor (perhaps on an existing concrete or asphalt surface away from working areas);
- If this is not available, steel tanks retrieved from the ships can be used within the storage area;
- Storage areas should have limited access and should be identified by a combination of signs in a bright colour in local language/s with a pictorial representation of the dangers;
- The sign should be visible from all directions and be a minimum of 120mm x 150mm;
- Fire extinguisher equipment should be available at the storage site; and

- Trained personnel only should be allowed into the storage area and they should be provided with appropriate protective clothing, including gloves, protective footwear and protection for eyes, face and skin and made to wear it.

2.1.3.2 Storage of Oils and Fuel

The following are guidance on the storage and management of oils and fuels within the storage area mentioned above.

- A small group of trained workers should be responsible for the process of pumping oils and fuels into onsite tanks;
- A 'Supervisor' should be employed to monitor the tank level to ensure avoidance of overfilling and therefore spillage;
- The storage tanks provided for containment of oils and fuels should have an impermeable base (and therefore not be contained in holes in ground materials (e.g. use of disused oil tanks frequently found at operational sites or in markets);
- Tanks should be specified in accordance with their application, this including definition of size, material manufactured from, and the adoption of 'tank full' marks;
- Tank location should be specified including: distance from ship, distance from other facilities, access for collection vehicles (ensure vehicles cannot hit tank using barriers); and
- The containment tanks should be identified by a sign within the storage area to highlight the specific material being stored with a pictorial representation of the danger.

2.1.3.3 Storage of Bilge and Ballast Water

The following are guidance on handling bilge and ballast water, which can involve water storage facilities within the storage area detailed above, or treatment in a separate facility:

- Ballast water if "dirty" should be treated as bilge water as it may contain significant quantities of oil;
- At locations where several ship-breaking yards are established and in operation, it may be feasible to develop one wastewater treatment plant serving all the individual shipbreakers. An alternative may be a reception facility (either existing or new) allowing the vessel itself to deliver bilge and ballast water prior to dismantling;
- Storage should be in open tanks for water evaporation;
- Tanks should be specified in accordance with their application, this including definition of size, material manufactured from, and the adoption of 'tank full' marks;
- Tank location should be specified including: distance from ship, distance from other facilities, access for collection vehicles (ensure vehicles cannot hit tank by using buffer);
- Small group of trained workers should be responsible for the process of pumping of bilge and ballast (same as oil and fuel team);
- 'Supervisor' employed to monitor the tank level to ensure avoidance of overfilling; and

- Workers have protective gloves and face masks.

2.1.3.4 Storage of Asbestos

Asbestos presents a significant long-term risk to worker's health and as such must be handled and stored to a higher specification than is the case with other materials. Any guidance on the subject of asbestos needs to emphasise the importance of correct handling and storage. The following can be seen as minimum standards for storage of asbestos:

- Temporary storage should be in plastic sheeting of a thickness (minimum 0.15 mm) sufficient to withstand tears when being handled and wrapped and sealed (e.g. tarpaulin);
- The packed asbestos should be completely sealed with adhesive tape;
- The containment material should be of sufficient size as to completely cover all of the contained asbestos and should be secured so as not to inadvertently open (e.g. wrapped to a minimum of two layers and pegged down);
- Each container should not exceed 0.75m in height and should not be stacked;
- The area around the asbestos should be identified by a large sign or combination of signs in a bright colour in local language/s with a pictorial representation of the danger; The sign should be visible from all directions and be a minimum of 120mm x 150mm; and
- The asbestos storage area should be located away from all other stored waste within the storage area and from all work areas so as to avoid damage to the plastic bags.

2.2 Risk to Human Health and Environment

2.2.1 Threats to the Workforce and Environment

Table 2-2: Risks to Human Health and the Environment

Materials and Hazards			
Potentially Hazardous Material	**Hazard**	**Threat to workforce**	**Threat to the Environment**
Oils and fuel	• Hydrocarbons • Sludge • Heavy metals • Explosive • Vapours	Highly refined petroleum products are toxic and also represent a fire and explosion hazard. Toxic hazards may impose serious health threats to workers if handled incorrectly. Main exposure routes are inhalation and consumption of contaminated fish and	Oils and fuels may poison marine organisms and physically soil the environment (birds, fish, plants, etc.). Oil spills also threaten natural resources

Materials and Hazards			
		water.	
Bilge and ballast water	• Oil and grease • Residual fuel • Petroleum hydrocarbons • Biocides • Heavy and other metals • Non-indigenous organisms	Ballast water may carry pathogenic organisms which threaten human health, potentially causing epidemics[5]	Threat to local and regional biodiversity may have severe economic consequences. Introduction of non-indigenous species disturbs ecological balance. Oil, petroleum, hydrocarbons, biocides and certain metals can have toxic effect on the external environment. Oil causes physical damage to the external environment
Asbestos	Asbestos fibres Asbestos comes in 3 types with varying degrees of risk. In the circumstances within the scope of this guidance note all types of asbestos should be treated as the most harmful.	Inhalation of high levels of asbestos fibres can lead to increased risk of lung cancer, mesothelioma and asbestosis	

2.2.2 Emergency Response Plan

2.2.2.1 Asbestos

Immediate action must be taken to prevent asbestos fibres from being released to the air in the event of an accident causing damage to a container. This is best done by immediately wetting the waste with water. Protective clothing, appropriate gloves, working shoes and an approved dust mask should be worn for this operation in order to prevent contamination of hair, skin and clothes. A water supply in the form of buckets or a hose pipe should therefore be available in the close vicinity of the storage site at all times.

2.2.2.2 Oil and Fuel, Bilge and Ballast Water

The main risk from oil and fuel storage, and for storage of bilge and ballast water which may contain oil, is fire. Fighting established oil or fuel fires is extremely difficult and should not be undertaken without the correct fire-fighting equipment. It would therefore be necessary under these circumstances to call in the emergency services.

The appropriate method to addressing the risk of fire in storage areas is to take every precaution to prevent fires starting. Naked flames (e.g. cigarettes) or equipment which can

[5] Cholera outbreak (Peru, 1991)

cause a spark (e.g. cutting equipment) should not be allowed within the designated storage area. The area should be kept clean and clear of all oily rags, waste paper or cardboard boxes etc. Supervisors should be employed in regular inspections of the storage area to ensure good housekeeping is maintained.

2.3 Resource Requirements

Training in hazardous material handling and storage will be required. This will involve an experienced trainer undertaking a short, practical, toolbox style course[6] to a small team of workers, who will then become 'supervisors' or an equivalent status which raises them above the regular workers. Follow-up training of this small group will be required at 6-monthly intervals or following turnover of trained workers.

Additional protective equipment will be required for the residual waste storage team, as mentioned above. This will incur modest additional expense.

The following is a broad list of materials and costs required to construct the storage area:

- Surrounding fencing: it should be possible to locate sticks and other materials available at or near the site which can be used for the construction of the surrounding fencing. Dead bushes, particularly those with spikes, are often used to keep livestock away from homes and gardens and the same system could be used for the construction of this facility;
- Signage: metal sheets will be required to form the backing for signs as these will be large and will need to be robust. Local markets or nearby villages frequently contain a person employed or proficient at sign-writing. The cost of producing signs, including the purchase of metal sheeting and a sign-writer will be in the range of $25 to $50 and 12 to 15 will be required for the storage area. However, it is likely that materials for fabrication of the signs will be available on site, appearing as scrap or unused materials. Utilising these materials would reduce the cost of signage considerably, to around $5 to $10 each.
- Suitable plastic (tarpaulin) will be required for asbestos storage. It is likely that large amounts of this will be needed, though with the movement of materials from the temporary storage site away from the shipyard smaller amounts will be purchased at regular intervals. It is likely that the cost of this will be in the range of $25 to $50 per month.
- Fire extinguishers will be the main expense for the storage area, unless sourced from a ship. The generally cost in the region of $50 to $100 each and 4 will be required to ensure they are available at each storage tank and at the entrance to the storage area.

3.0 IMPLEMENTATION OF SOLUTION

The proposed solutions provided in this guidance note will require further work to develop into full guidance documentation to the benefit of the ship recycling operators and workers.

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[6] On-site, brief, training using visual and practical techniques

As such, the following section offers recommendations on how the guidance could be implemented by the operators and workers.

3.1 Proposed Format for the Guidance Documents

Overall, the document should rely on pictorial representation as much as reasonably possible, reflecting the likely lower level of literacy at the site. The document should be translated into all local languages. Checklists should be used to ensure all actions and safeguards have been met before work begins and that regular checks are undertaken to ensure a continued safe storage environment.

The guidance documentation should include clear instructions on the size and design of hazardous storage unit and hazardous storage area warning signs. These instructions should include pictures of existing signage, preferably in-situ, to show real examples.

On-site training should involve (where not detrimental to health) actual materials, for example bilge water containing oils seen on-site, fuel oils etc. This will allow the trainees to be able to identify the range of hazardous residue they will ultimately be working with.

3.2 Barriers to Implementation

Barriers to implementation are not high, although as the issue of storage of hazardous residues is often not recognised as a cause of danger or environmental damage, there may be some unwillingness to change current practice.

3.3 Overcoming Barriers to Implementation

Awareness of the risks associated with inadequate storage of residuals needs to be raised. Ship recycling facility owners may be encouraged to know that having an aware, safe, workforce could potentially lead to less disruption to operations.

Training should place emphasis on the benefits in following basic guidelines, both in terms of the health of the workforce and the environment, and its knock-on effect on the livelihoods of their community.

3.4 Proposed Training Schemes

Training should be provided for specific residue storage teams. This should be conducted by an experienced trainer and be provided for each team member initially, new team members following changes and on a 6-monthly ongoing basis. The methods should be very hands-on and look-and-see based.

Training should also be provided to residue storage teams on servicing fire extinguishers. This would only need to be a brief, site-based display using an older extinguisher which allows trainees to dismantle and check the operation of fire extinguishers, with a brief list of what to look out for each time inspections are made.

APPENDIX 3-4

TECHNICAL GUIDANCE NOTE ON

WORKING AT HEIGHTS INCORPORATING PREVENTION OF FALLS FROM HEIGHT

APPENDIX 3-4

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1.0 SUBJECT OF GUIDANCE NOTE

1.1 Description of Issue

From the output of the stakeholder engagement at Alang, India, working at height and objects falling from height were identified as the most frequent causes of death and injury in the shipyards. A place is "at height" if a person could be injured falling from it, even if it is at or below ground level.

The main reasons falls occur are:

- Unstable or slippery surface;
- Surface is not capable of supporting a load;
- Unprotected edges or holes;
- Person struck by object falling from height;
- Incorrect use of ladders;
- Slips, trips and falls; and
- External factors, such as high winds and rain.

To reduce the risk of falls from height, all but external factors can be controlled.

1.2 Justification

As working at height or objects falling from height are some of the biggest causes of injury[1] in the ship recycling industry it is a key target for improvement. Failure to do so is very likely to lead to continued injuries and deaths.

Considering the relatively low cost of implementing the proposed solutions outlined in this guidance documentation, the uptake of the proposed solutions should be relatively easy for the ship recycling operators, and thus significant improvements can be realised for limited investments.

1.3 Findings from Research

Coordination between parties working on different areas of a ship is often lacking, which can lead to situations in which workers are in potentially dangerous positions below works encompassing cutting, material movement, or other activities. As witnessed from site visits and research, there are often no demarcated areas on the ships, resulting in workers unknowingly crossing into unsafe situations.

[1] Interviews at Alang shipbreaking yard, India, undertaken by Golder

1.4 Aim of Proposed Solution

The aim of this solution is to raising awareness of the dangers from working at height and to propose suitable ways of working which, if adopted, will reduce injuries and death in situations where working at height is necessary.

2.0 TRANSITIONAL TECHNOLOGY SOLUTION

2.1 Technical Description

2.1.1 Hierarchy of Control

As with all health and safety issues, when working at height the hierarchy of control must be considered, as follows:

- Reduce or eliminate;
- Minimize the risk by using safe systems of work; and
- Protect with personal protective equipment (PPE).

2.1.2 Safe Ship Recycling Plan

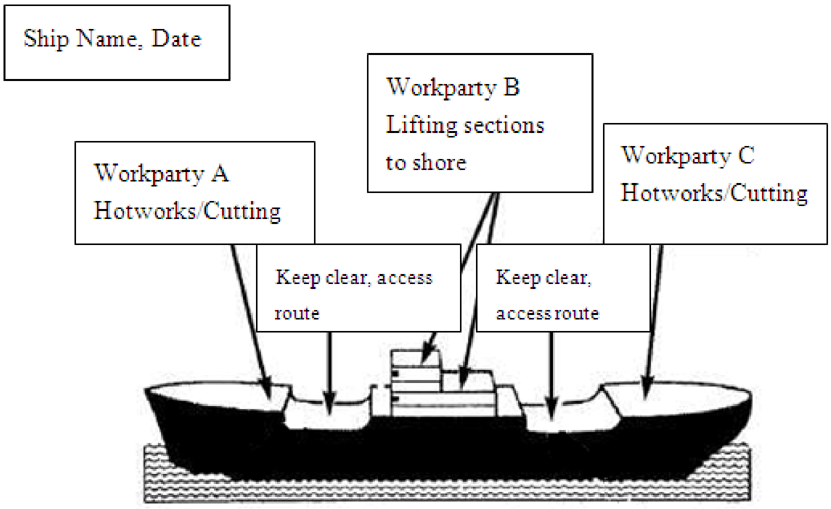
As working from height cannot be completely eliminated, the best way of preventing accidents and injury is to minimize the risk with a safe system of work. The first stage of this is to have an overall plan outlining how the ship will be taken apart. In the guidance "Safety and Health in Shipbreaking", the ILO refers to this as a *Safe Shipbreaking Plan*.

Ideally this plan should:

- Identify the different phases of work needed;
- Ensure adequate entry and exit routes are maintained at all times; and
- Help inform a daily work plan to ensure coordination between work parties so workers are aware and take precautions when working below areas where other work is being carried out.

Below is an outline of a simple work plan, showing what is happening in each area of the ship and thus which areas need to be kept clear. A large General Arrangement diagram of the ship should show access routes and be updated on a daily basis as appropriate.

Figure 2-1: Simple Work Plan



Workparty A	Access via ladder A, routes marked with Green Paint
Workparty B	Access via ladder B, routes marked with Yellow Paint
Workparty C	Access via ladder C, routes marked with Blue Paint
No work to be carried out at lower levels due to work above.	

2.1.3 Unstable or Slippery Surface

During the initial inspection of the vessel after arrival at the shipyard, any area with slippery surfaces should be identified and clearly marked. Spillages could be cleared up. If it is oil which has been spilt this should be cleared up with sawdust and the source of spill be located to ensure further leaks and spills cannot happen.

Unstable surfaces should be clearly marked with large pictorial signs demonstrating the location as unstable/slippery. A suggestion of a sign which could be used is shown in **Table** 2-1**.**

2.1.4 Surface is Not Capable of Supporting a Load

Good housekeeping should be observed at all times. Materials should not be piled up on unstable or fragile surfaces. Designated areas for storage should be identified and clearly marked. Supervisors need to make sure these are adhered to.

2.1.5 Unprotected Edges or Holes

Where possible work near unprotected edges should be avoided and the guard rails on the ship could be left in place as long as possible. If there are no guard rails, rope can be used to construct a barrier. A simple plan needs to be drawn up outlining how the ship is to be taken apart. This planning will help identify where the risks will be.

Holes in the ship deck or working surface should be covered or cordoned off with rope or tape.

2.1.6 Person Struck by Object Falling from Height

The risk of objects falling from height could be reduced by:

- Ensuring all non essential workers are out of the way of any drop zone;
- Ensure any such areas are clearly marked and signed. Suggested signs are shown in **Table** 2-1;
- Carrying out visual checks to ensure area below is clear before starting work;
- When lifting or lowering equipment ensure a trained worker acts as banksman. The banksman's role is to identify unstable loads which are likely to fall and to look out for people coming into the area below where the lifting operations are taking place;
- Good housekeeping. Ensure objects are not left where they could fall, and
- At the start of the day check the work plan to see who is working where, and adjust work patterns if necessary to avoid parties working below other areas of work.

2.1.7 Ladders

Where ladders are to be used for access, these should be securely tied on and inspected before beginning work to ensure there is no excessive wear and tear to the rungs and other parts.

2.1.8 Slips, Trips and Falls

The risk of slips, trips and falls while working at height can be reduced by:

- Good housekeeping: do not leave objects where they can cause a trip hazard; and
- Where practical ensure good lighting. The ships own lighting should be kept operational as long as possible, and once this in no longer available, holes could be cut into the side of the ship to allow daylight in. These holes need to be located so they give even lighting and do not in themselves cause a hazard.

2.1.9 External Factors, such as High Winds and Rain

Work at height should not be carried out in high winds or heavy rains as this increases the risk of accidents occurring. If it is windy, a new work plan should be drawn up for that day to enable work to carry on in other parts of the ship.

2.1.10 Signage

Warning signs need to be pictorial and easy to understand. It is suggested that the signs in **Table 2-1** could be used.

Table 2-1: Possible Warning Signs[2]

Design	Meaning/Use
	**Beware of objects falling from height** This should be placed in any area where work is being carried out above.
	**Slippery surface** This should be placed around any spills/leaks which may make the surface slippery. A sign must be placed at all possible directions of approach.
	**No Entry** This can be placed around all sides of a cordoned off area. All possible approaches should have a sign clearly visible.
	**Fragile Surface** This indicates a surface that is not safe to walk on, or to store materials on.

[2] Copyright BS 5499-5:2002 (free use)

Design	Meaning/Use
	**Risk of Falling** During the initial inspection of the ship this sign should be placed anywhere there is an unguarded edge or a risk of falling.
	**Trip Hazard** This sign should be used to warn of any trip hazards which cannot be removed,

2.2 Near Misses

Identifying and reporting near misses is a very effective way of reducing accidents. A near miss is an unplanned event that did not result in injury, illness, or damage, but had the potential to do so. If near misses are reported, and the causes of the near miss acted on, an accident can be prevented altogether.

2.3 Resource Requirements

The major resource required will be time for training and to carry out checks before beginning work.

It is estimated the initial training will take half a day per worker, which could be incorporated into any induction programme currently in place. The toolbox talks[3] would take no more than an hour, and be conducted on a monthly basis.

Additional minor resources will be required for the production of the signs proposed, where these can be painted at site onto any thin metal sheets arising from the recycling works and cut to size.

2.4 Risk to Human Health and Environment

The risks to human health from working at height can range from sprains and broken bones to spinal injuries and death. Objects falling from height can cause crushing injuries, head injuries and death. If measures such as those suggested in this guidance are not implemented, there is unlikely to be any significant improvement in injury rates and the risk of such incidents will remain.

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[3] On-site, brief, training using visual and practical techniques

3.0 IMPLEMENTATION OF SOLUTION

The proposed solutions provided in this guidance note will require further work to develop into full guidance documentation to the benefit of the ship recycling operators and workers.

As such, the following section offers recommendations on how the guidance could be implemented by the operators and workers.

3.1 Proposed Format for the Guidance Documents

We would envisage the guidance documentation to be mainly pictorial with supporting text and contain a typical checklist to complete before beginning the task. This checklist would include diagrams explaining the areas that need to be cordoned off during work and how this is to be achieved.

Toolbox talks can be used to explain how areas can be made safe or cordoned off and the proper use of ladders.

3.2 Barriers to Implementation

The selection of language used in the guidance documentation can be a barrier since all workers at a site may not speak the same language and some may be illiterate.

Workers may be reluctant to report near misses or accidents for fear of being disciplined.

3.3 Overcoming Barriers to Implementation

All information needs to be available in all relevant languages. Where appropriate every effort should be used to utilise clear diagrams to address the problem of low literacy levels. The training packages need to emphasise the risks of working at height and how simple measures can be put in place to help reduce risks.

Ship recycling yard owners could run incentive schemes to encourage reporting of near misses or accidents, with no fear of action being taken against the worker. If a worker brings to light a particular safety issue they could receive a small financial reward. This would also show that shipyards are willing to listen to workers concerns.

3.4 Proposed Training Schemes

Training should be given before any worker starts on site, with annual refresher courses.

Practical toolbox talks should be held on a regular basis e.g. monthly. The topic for these could be suggested by the workers or based on any near misses which may have happened.

APPENDIX 3-5

TECHNICAL GUIDANCE NOTE ON

PROCEDURES FOR HANDLING STORED ENERGY SYSTEMS INCLUDING CABLE MANAGEMENT

APPENDIX 3-5

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1.0 SUBJECT OF GUIDANCE NOTE

1.1 Description of Issue

Stored energy can take many forms where at ship recycling yards it is commonly found in the following:

- Chemical energy, for example: petroleum and propane;
- Stored mechanical energy for example: compressed springs and tensioned cables;
- Gravitational energy, for example: plant and ship sections resting on the ship's structure; and
- Electrical stored energy, for example: in batteries and capacitors.

A frequently occurring problem encountered at ship recycling yards is the stored energy in tensioned cables that are used for pulling apart sections of ships and used to pull sections of ship closer to the shore. Consequences from cables breaking when used are significant and often involve personal injury such as lacerations and in extreme cases severing of body parts.

1.2 Justification

Injuries from cable failure are frequent at ship recycling sites. Cable failure carries a high risk of causing injury due to the unpredictability of the event and direction as well as its high energy release.

Relatively simple and effective management schemes can be applied to reduce the risk of cable failure as well as the handling of their stored energy systems.

1.3 Findings from Research

Current practise in ship recycling yards is to pull cables from the winch and attach the pulling cable directly to the section of ship to be pulled. It is evident that these sections are pulled by trial and error and that no assessment of the size and weight of the section is typically made before pulling commences. Only if/when the winch fails to pull the section is there any consideration given to reducing the size of load to be pulled. This method could potentially lead to the cable snapping, which would lead to a higher risk of injury.

No evidence during the site visits for this study or through other research indicates that cables are inspected. Equally, maintenance to cables appears to be limited to repair of snapped sections.

There is currently no available information on how other stored energy systems are currently managed at the ship recycling yards in developing countries.

1.4 Aim of the Proposed Solution

The aim of this appropriate solution is to reduce the risk from cable failure and other stored energy threats by raising awareness of what constitutes stored energy, the threats from them, and offering some solutions to reducing the risks posed.

2.0 TRANSITIONAL TECHNOLOGY SOLUTION

2.1 Technical Description

2.1.1 Identification

Reducing the risk from electrical and mechanical stored energy situations is relatively simple. The key is to identify the risk and then safely discharge the energy or put it into a safer state.

An electrician should inspect each and every vessel once beached to identify any electrical stored energy. This may include the disconnection of generators and batteries and the discharging of any capacitors.

A qualified person should also inspect the ship for potential chemically and mechanically stored energy situations such as the following:

- Objects suspended or held back, such as doors, lifts and hoists;
- Objects located next to open edges that may be readily knocked over the edge during the dismantling operation;
- Stored fuels and other highly flammable / combustible materials (fuels stored in fuel tanks not covered by this guidance note);
- Cables and ropes in tension; and
- Coiled springs and latches.

Following identification, a plan to discharge each energy state should be developed and undertaken, which could be as follows:

- Suspended or held back objects should be released in a controlled manner with all persons away from any reaction from the stored energy;
- Objects located next to open edges could be: a) moved back to a safe distance from the edge; b) dropped over the edge, with an exclusion zone establish below; c) secured to a strong point, for example use ratchet straps to secure an object to the ship structure or carefully lower the object to ground level using appropriate lifting equipment;
- Stored fuels should be carefully removed from the ship and placed in a secure location within the ship breaking yard;
- Cables and ropes in tension should be assessed to consider the effect of releasing the tension, if safe to do so then they should be released; and

- Coiled springs and latches should be gradually released in a controlled manner.

2.1.2 Cable Inspections

There are few transitional technology alternatives to using a cable and winch to pull the cable closer. Whilst regular inspection of the cables will be of some benefit, steel cables will often deteriorate from the inside outwards with little or no obvious evidence of deterioration until failure.

The following cable inspection regime could be employed:

2.1.3 Pre-Use Inspection

Good practice requires that all visible parts of a wire rope should be subject to a daily or weekly inspection as far as is possible (depending on how often the wire rope is used). Such inspection should be aimed at detecting general deterioration and deformation. If damage is detected, it should be reported and recorded and the wire rope examined by an appropriate competent person, i.e. a local manufacturer of cables.

2.1.4 Thorough Examination

Thorough examination of at least the full working length plus three wraps / coils of the wire rope (including hook end termination) should be carried out at periods not exceeding twelve months. The thorough examination will need to be undertaken by a trained and experienced person and should record as well as take account of:

- Statutory requirements, where applicable;
- Type of appliance and/or design of the system;
- Operational environmental conditions;
- Method and frequency of operation;
- Manufacturer’s recommendations;
- Results of previous inspections and thorough examinations;
- Experience with previous wire ropes on the appliance or system;
- Analysis of usage history; and
- Previous wire rope history – this should include a review of weigh load records where available.

2.1.5 Wire Rope Non-Destructive Examination (NDE)

Wire rope NDE should ideally be undertaken as part of a thorough examination, this being undertaken by trained and experienced persons.

NDE instruments for steel wire ropes employ strong permanent magnets in the magnetic head. These magnets supply a constant magnetic flux that saturates the rope as it passes through the head. Total axial magnetic flux is measured by sensors with output being proportional to the amount of steel rope in the head and therefore indicating any change in cross-sectional area. This is commonly referred to as loss of metallic area (LMA) and can be used to indicate corrosion and or wear.

Magnetic flux leakage created by any discontinuity in the rope, such as a broken wire, corrosion pitting or inter-wire fretting, can be measured using differential sensors. These are commonly referred to as local faults (LF).

NDE instruments may be designed to detect LMA, LF or both.

Figure 2-1: Wire Rope NDE Test Equipment

(from: IMCA "Guidance on Wire Rope Integrity Management for Vessels in the Offshore Industry", October 2008)

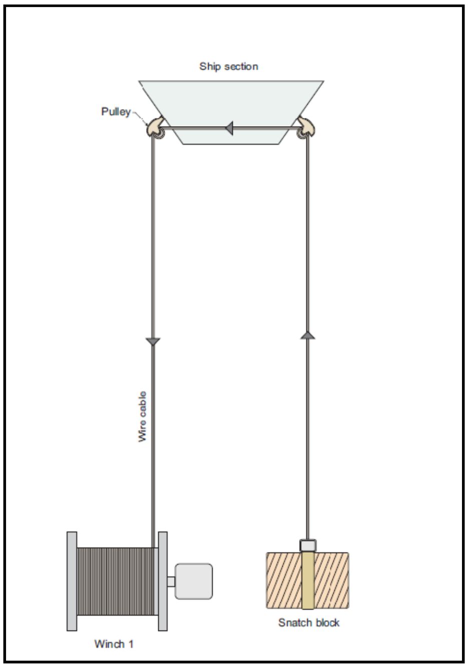
2.1.6 Awareness Training

Whatever safety improvements to cable pulling are made it is still possible and likely that failure of the cables will occur. Such failure in the cable will always present safety hazards to operatives and therefore the facility should be prepared for such failure. At many sites the system of audible siren ahead of winching operations is used. However, this is not always heeded by those working at the site. A process of awareness-raising is therefore required to inform workers of the dangers of stored energy systems like winches. This should clearly show the risks and hazards during cable pulling, including showing the consequences of being struck by a cable. The training could utilise any instances on the site where the pulling is taking place and any images used of injuries as a result of accidents caused when workers have not headed warnings.

2.1.7 Decrease the Load in the Cable

It is feasible to decrease the load in the pulling cable by half by use of a snatch block without decreasing the load being pulled, though this should not be interpreted as an opportunity to increase the size of the load being winched. Refer to **Drawing 2-1**.

Drawing 2-1: Solution to Reduce Load in Cable



To use this method, the following procedure should be followed:

- Install a snatch block (a pulley block that can be opened on the side to receive the bight of a rope) to a secure location next to the winch;
- Attach at least one suitably sized pulley to the ship section to be pulled (it is important to use a pulley and not to try to pass the rope through a hole in the ship);
- Pull out the pulling cable and pass it through the pulley(s);
- Continue to pull the cable out towards the snatch block;
- Secure the pulling cable to the snatch block;
- Take up the slack in the cable;

- Commence pulling of the section (note that using this method will double the pulling time required); and
- As required cease pulling and adjust cable line.

2.1.8 Extending Lifespan of Cable

It may be feasible to extend the lifespan of the cable by using the practice known as 'end-to-ending.' This would involve removing the cable from the winch and rewinding starting from the opposite end of the cable. This has been shown to extend the life of the cable from 4 to 5 years on average[1].

2.2 Resource Requirements

Inspections for stored energy systems will require competent engineers including an electrician. The cost of employing competent engineers to inspect each ship that arrives could be of the order $500 to $1,000.

Inspections prior to use will require input from a competent person.

A thorough inspection and an NDE will require a competent and trained person. Additional testing equipment will also be required. However it is envisaged that this work will be undertaken by a third party analysis company. Anticipated costs for undertaking this will be in the region of $3,000 to $6,000 per year for each ship recycling yard. A simple visual cable inspection regime cables could be carried out by a supervisor at the yard at much reduced cost, although this would not pick up hidden defects in the cables.

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[1] **The Merchant Shipping (Life Saving Appliances for ships other than ships of classes III to VI(A)) Regulations 1999 SI 2721**

Operational readiness, maintenance, inspections and servicing

84.(1) All life-saving appliances shall be in working order and ready for immediate use before any ship commences a voyage and at all times during the voyage.

(2) As far as practicable, maintenance of life-saving appliances shall be carried out in accordance with the instructions for on-board maintenance, or in accordance with a shipboard planned maintenance programme which includes the requirements of Schedule 14, Part 2 of MSN 1676(M).

(3) (a) Falls used in launching shall be turned end for end at intervals of not more than 30 months and be renewed when necessary due to deterioration or at intervals of not more than five years, whichever is earlier. Stainless steel falls, however, need not be renewed within the lifetime recommended by the manufacturer or supplier if, on inspection, there are no signs of mechanical damage or other defects.

(b) The Secretary of State may accept in lieu of the "end for ending" required in paragraph (3)(a), periodic inspection of falls and their renewal, whenever necessary, due to deterioration, or at intervals of not more than 4 years, whichever one is earlier.

(4) Spares and repair equipment shall be provided for life-saving appliances and for any of their components which are subject to excessive wear or consumption and which need to be replaced regularly.

Apart from the time required of yard personnel, awareness training will not require any additional resources and will be effectively free of charge.

The solution for reducing the load in the cables will require appropriate pulleys, snatch block and additional wire cable. It is envisaged that the snatch block will be fitted to a permanent secure structure, possibly purpose-built and likely to cost in the region of $15,000. The snatch block and pulleys are likely to cost in the region of $3,000 to $6,000 depending on capacity. Additional cables could possibly be sourced from the ships being scrapped. The recycling yard maybe able to source suitable pulleys, cables and winches from recovered ships to fabricate and install a snatch block at much reduced cost.

2.3 Risk to Human Health and Environment

Should these guidelines not be carried out then a continuation of major injuries from stored energy systems are likely to occur.

Furthermore, ships destined for recycling are becoming more modern, leading to increased risk of electrical stored energy systems since these ships will have digital control systems. There is a risk that local electricians at the ship recycling yards may not be knowledgeable of these systems, increasing the risk of incidents. This requires increased awareness raising as proposed in this guidance documentation.

3.0 IMPLEMENTATION OF SOLUTION

The proposed solutions provided in this guidance note will require further work to develop into full guidance documentation to the benefit of the ship recycling operators and workers.

As such, the following section offers recommendations on how the guidance could be implemented by the operators and workers.

3.1 Proposed Format for the Guidance Documents

It is envisaged that the guidance documentation for the identification of stored energy systems, testing of cables and the solution for decreasing the load in cables will be largely text-based, with supporting pictures and diagrams.

The guidelines on awareness training should consist mainly of pictures.

3.2 Barriers to Implementation

It is envisaged that the guidelines for testing of cables will be the most difficult to implement as this will involve using competent testing companies for inspections. The result of these inspections will, at times, be to either reduce the safe working load of cables or condemn the cable as unfit for use. This will be seen as an additional cost for the ship recycling yards.

3.3 Overcoming Barriers to Implementation

Any training developed would need to emphasise the risks of working with stored energy systems and the need for scheduled and appropriate testing, as well as highlighting how these measures can help reduce risks. All information needs to be available in multiple languages and be pictorial wherever possible. Where appropriate, clear diagrams should be used.

To support the use of competent testing companies for the cables used at the recycling yards, the yard operators could be supported in communicating the improvements they have made to the ship owners (also through the brokers) on their safer systems of work. This in turn can help to promote their recycling business as being sustainable

3.4 Proposed Training Schemes

Stored energy systems training should be given to all new starters and to people who plan to undertake the identification process. Refresher training should be given every 6 to 12 months.

The Cable Testing Procedure is aimed at managers and supervisors of the works.

The solution to reduce the load within the cables is proposed as a new method of works for the ship yard.

APPENDIX 3-6

TECHNICAL GUIDANCE NOTE ON

MANUAL LIFTING

APPENDIX 3-6

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1.0 SUBJECT OF GUIDANCE NOTE

1.1 Description of Issue

Manual lifting may be defined as "any moving, lifting or holding of a load or weight by a person or many people."

At present many ship breaking yards in developing countries regularly use large labour gangs to move and lift materials and equipment. It has been noted that items commonly moved manually include the following:

- Pulling out of cables from winches;
- Loading steel plates into trucks; and
- Removal of waste material including oily sludges, muds and sands from within the ship.

1.2 Justification

In European countries approximately one third of all time-loss injuries are as a result of manual lifting injuries. In countries where ship recycling is prevalent and the use of lifting machinery is often not utilised (because, in some developing countries labour is cheaper than buying, operating and maintaining lifting equipment), it may be assumed that this figure will be higher.

The vast majority of manual lifting injuries are strains, with nearly half of all manual lifting injuries in the EU affecting the back. Infections can also be the result of laceration injuries, resulting from handling large, heavy metals with sharp edges.

1.3 Findings from Research

1.3.1 Pulling out of Cables from Winches

A pulling gang is used to remove cables, involving the workers supporting the weight of a heavy steel cable on their shoulders. The gang move this cable to the section of ship to be pulled closer to the shore. The cable pulling workers will often be bare footed or have their feet wrapped in a cloth and will clamber across uneven sharp metal surfaces to pull the cable out to the desired location. The steel ropes are large diameter, sometimes in excess of 2”, and can weigh in excess of 10 kg/m. The cable pullers will often have to pull from the ship several hundred metres of cable with a total weight in excess of 1 tonne.

1.3.2 Loading of Steel Plates into Trucks

Large, heavy steel plates are lifted and transported by gangs of around 10 workers. The steel plates are roughly cut and may still be hot from the cutting process while being lifted. The plates are of typical dimension of 2.5 m x 1.5 m x 0.02 m thick and each can weigh in excess of 500 kg.

1.3.3 Removal of Waste Materials

Waste materials left within the ships are manually removed. Occasionally this can involve the heavy lifting of unstable materials or materials poorly stored.

1.4 Aim of the Proposed Solution

The aim of the transitional technology solution is to remove wherever possible any requirement for manual lifting, or where this is not possible give the operatives adequate training to minimise the risk from manual lifting.

2.0 TRANSITIONAL TECHNOLOGY SOLUTION

2.1 Technical Description

These guidelines give examples of possible elimination or reduction of manual lifting by utilising other methods of work and equipment.

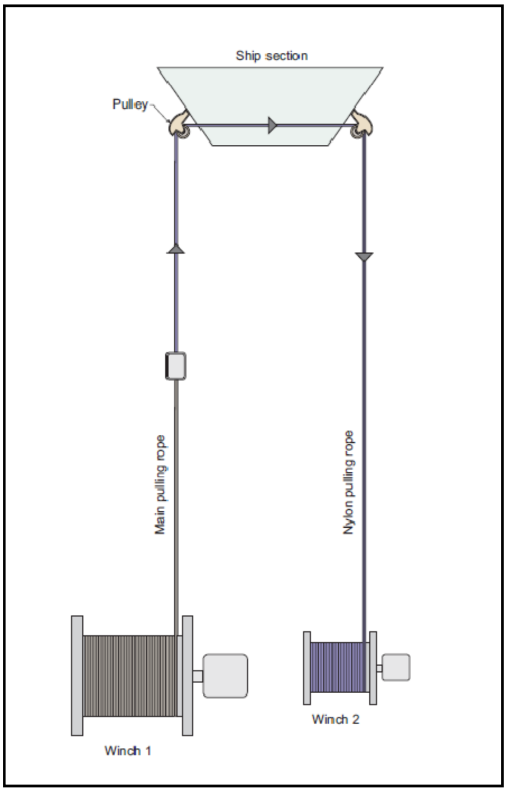
Additionally this guidance gives advice on how to undertake safe manual lifting.

2.1.1 Alternatives to Manual Lifting

Possible alternatives to manual pulling of the cable out from the winch to the ship section that is to be brought closer to the shore are as follows:

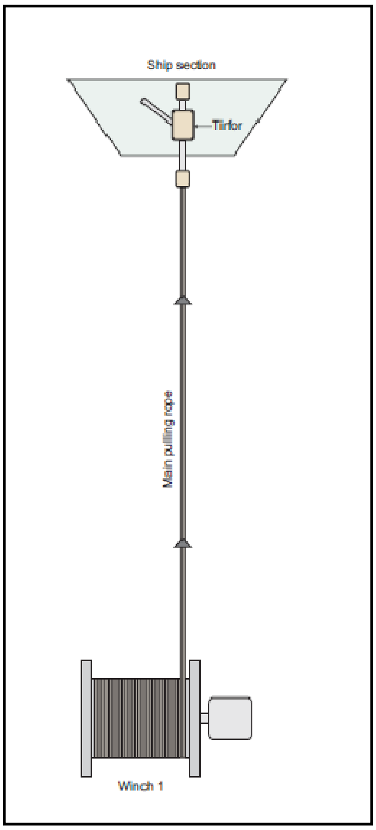
1. Position another winch (winch 2) next to the main pulling winch (winch 1). This can be of much smaller pulling capacity. Secure using shackles through strong structural sections of the ship. Winch 2 should contain a light nylon rope or similar rope of approximate safe working load of 5 to 10 tonnes; note the safe working load should be at least 50% greater than the total weight of the main steel pulling rope on winch 1. The length of the nylon rope will need to be at least twice the length of the main pulling rope of winch 1. The nylon rope should be pulled out and passed through the pulleys and then back and secured to the main pulling rope on winch 1. Once secure winch 1 should be allowed to disperse its rope freely. Winch 2 should now be able to pull out the main pulling rope. This should be done gradually, in short lengths, as the line of cable may need to adjusted over scrap metal and other obstacles around the yard. Refer to **Drawing 2-1** for details.

Drawing 2-1: Solution 1 for Cable Pulling



2. Secure a tirfor (aka grip-hoists) to the section of the ship to be pulled. The tirfor and tirfor wire rope should have a safe working load of at least 50% greater than the total weight of the main pulling rope on the main pulling winch. The tirfor wire rope should be pulled out and attached to the main pulling rope. Once secure, winch 1 should be allowed to disperse its rope freely. The operative can now manually, using the tirfor, pull out the main pulling rope. This should be done gradually, in short lengths, as the line of cable may need to be adjusted over scrap metal and other obstacles around the yard. Potentially an old ship's capstan could be adapted and used for this purpose. The capstan could be electrically, mechanically or manually driven depending on availability of technology. Refer to **Drawing 2-2** for details.

Drawing 2-2: Solution 2 for Cable Pulling



A possible elimination example to manual lifting of steel plate is as follows.

1. Use a 360 degree excavator, crawler crane or a telescopic handler of suitable size to carry and operate a scrap magnet. Mobile plant such as 360 degree excavators (tracked or wheeled), crawlers and even telescopic handlers can be fitted with either an electronic or hydraulically driven magnet. Power to operate either an electric magnet or hydraulic magnet can usually be achieved directly from the base machine (i.e. crawler crane or excavator unit). Refer to **Figure 2-1** below.

Figure 2-1: A Magnet Used for Scrap Lifting

(from: http://www.ohiomagnetics.com/images/OM_scrap_magnets.jpg)

A possible alternative to manually transporting and loading steel plates to wagons is as follows:

1. Setting up a ramp and using a winch or tirfor to 'skid' the steel plates onto the truck. Attach a winch or tirfor to the back of the truck, erect and secure a ramp at the end of the truck (a ramp could be constructed on site by welding spare steel sections together, or from an earth/soil ramp construction). Wind out the wire rope from the winch or tirfor. The wire rope should have a safe working capacity of at least 1 tonne. Attach the wire rope to the lifting chain leg set and then attach the chains onto the steel plate. This can be done using magnetic plate lifters (to avoid cutting holes in the steel plates, see examples in **Figure 2-1** and **Figure 2-2**), it is recommended that at least two magnets are used, more if necessary. The plate lifters do not need a power supply. Position the magnets on the steel plate and activate. Commence winching the plate onto the ramp and truck. This should be done gradually, in short lengths, as the line of cable may need to be adjusted over scrap metal and other obstacles around the yard. It also may be necessary to lever the plate onto the ramp to assist the operation. Refer to **Drawing 2-3** and **Figure 2-2** below for details.

Drawing 2-3: Solution 2 for Plate Loading

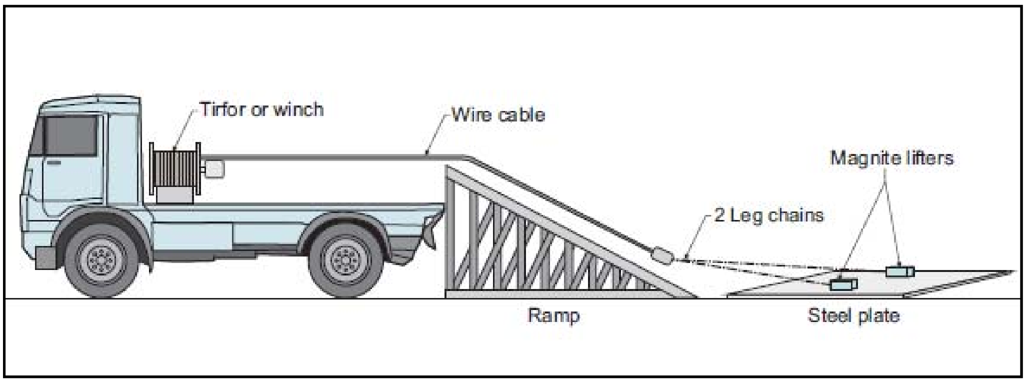


Figure 2-2: 2 A Magnetic Plate Lifter

(from: http://www.eclipse-magnetics.co.uk/product-categories/liftingmagnets/ultraliftplusliftingmagnet)

2.1.2 Good Manual Lifting Practise

Where manual lifting is unavoidable, appropriate training should be given to operatives, some simple guidelines to manual lifting are detailed below:

- **Think before lifting.** Plan the lift. Can lifting aids be used? Where is the load going to be placed? Will help be needed with the load? Remove obstructions such as discarded wrapping materials. For a long lift, consider resting the load midway on a table or bench to change grip.
- **Keep the load close to the waist**. Keep the load close to the body for as long as possible while lifting. Keep the heaviest side of the load next to the body. If a close approach to the load is not possible, try to slide it towards the body before attempting to lift it.
- **Adopt a stable position.** The feet should be apart with one leg slightly forward to maintain balance (alongside the load, if it is on the ground). The worker should be prepared to move their feet during the lift to maintain their stability. Avoid tight clothing or unsuitable footwear, which may make this difficult.
- **Get a good hold.** Where possible the load should be hugged as close as possible to the body. This may be better than gripping it tightly with hands only.
- **Start in a good posture.** At the start of the lift, slight bending of the back, hips and knees is preferable to fully flexing the back (stooping) or fully flexing the hips and knees (squatting).
- **Don’t flex the back any further while lifting.** This can happen if the legs begin to straighten before starting to raise the load.
- **Avoid twisting the back or leaning sideways**, especially while the back is bent. Shoulders should be kept level and facing in the same direction as the hips. Turning by moving the feet is better than twisting and lifting at the same time.
- **Keep the head up when lifting.** Look ahead, not down at the load, once it has been held securely.
- **Move smoothly.** The load should not be jerked or snatched as this can make it harder to keep control and can increase the risk of injury.
- **Don’t lift or handle more than can be easily managed.** There is a difference between what people can lift and what they can safely lift. If in doubt, seek advice or get help.
- **Put down, and then adjust.** If precise positioning of the load is necessary, put it down first, and then slide it into the desired position.

2.2 Resource Requirements

Solution 1 to cable pulling will require less labour than normal to handle the cable; it is envisaged that this operation can be reduced to four people (one to operate the winch, two to set up and guide the rope and one to control the operation). It will require the purchase of an additional winch which is envisaged to cost in the order of $1,500 and approximately 500m of appropriate rope which is likely to cost less than $150. Pulleys are also required which are likely to cost in the order of $50 each. Winches are often found on ships and it may be possible to procure a pulley off a recycled ship.

Solution 2 to cable pulling will require less labour normal to handle the cable, it is envisaged this operation can be reduced to four people (one to operate the tirfor, two to set up and guide the rope and one to control the operation). It will require the purchase of a tirfor which is envisaged to cost in the order of $800 and approximately 500m of appropriate rope which is likely to cost less than $150. A capstan maybe available onboard a ship being dismantled and could be salvaged for this purpose.

Solution 1 to loading the plates will require less labour than normal to handle the plates, it is envisaged this operation can be reduced to three people (one machine operator, one banksman and one to guide the plates onto the truck). It will, however, require a loading machine (excavator, telescopic handler, crawler crane etc) the cost of these can vary from $10,000 to over $150,000 depending on age, type, condition, operated hours. Additionally a magnet will be required which will cost of the order of $6,000 and upwards depending on age, condition and size. To reduce the costs to the recycling yards, they may be able to recover older machinery for refurbishment and repair.

Solution 2 to loading the plates will require less labour than normal to handle the plates, it is envisaged this operation can be reduced to four people (one to operate the tirfor or winch, two to set up and guide the rope and one to control the operation). It will require the purchase of a tirfor envisaged to cost in the order of $300, a winch of the order of $750 and approximately 500 m of appropriate rope which is likely to cost less than $150. Magnetic lifters are required a 600 kg lifter cost approximately $500 (a minimum of two would be required). A ramp to assist the operation can be constructed by welding spare scrap metal sections together on site.

Training of the operatives could be given by site supervisors themselves trained in the working methods. The additional costs for this would therefore be the time for operatives to be given the training.

2.3 Risk to Human Health and Environment

Should this guidance not be followed, based on European data, poor health including back pain will be suffered by operatives' involved in manual lifting. Lacerations from lifting sharp, heavy metal could cause severe infections.

3.0 IMPLEMENTATION OF SOLUTION

The proposed solutions provided in this guidance will require further work to develop into full guidance documentation to the benefit of the ship recycling operators and workers.

As such, the following section offers recommendations on how the guidance could be implemented by the operators and workers.

3.1 Proposed Format for the Guidance Documents

We would envisage that the guidance documentation would be mostly pictorial, supported by text. A checklist for each of the solutions could be developed to assist operatives setting up the system until they became familiar with the operation.

The manual lifting guidance can be mainly pictorial.

3.2 Barriers to Implementation

The likely barriers to implementing both the cable pulling and plate lifting solutions should not be insurmountable and are likely to be:

- Cost for the purchase of the various additional plant and equipment needed;
- Language where due to the number of languages typically spoken at sites, any guidance documentation and training packages would need to be in several languages; and
- Labour issues since each of the proposed solutions will potentially use less labour, which may upset the current arrangements for labour.

3.3 Overcoming Barriers to Implementation

All information needs to be available in multiple languages. Where appropriate, clear diagrams should be used, along with information on how to obtain materials and equipment cheaply.

Work is required with labour groups and representatives to off-set any reductions in labour requirements but provide improvements in skills and safety.

3.4 Proposed Training Schemes

For the solutions to cable pulling and plate lifting, it is envisaged that training could be provided to new starters. This could be introduced to more experienced operatives as a new method of working.

The manual lifting guidance should be given to all as a toolbox talk[1] and refreshers given every 3 to 6 months.

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[1] On-site, brief, training using visual and practical techniques

APPENDIX 3-7

TECHNICAL GUIDANCE NOTE ON

ACCESS INCORPORATING CONFINED SPACES AND ILLUMINATION

APPENDIX 3-7

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1.0 SUBJECT OF GUIDANCE NOTE

1.1 Description of Issue

A confined space can be defined as any place that, by virtue of its enclosed nature, poses a foreseeable specified risk. The potential risks inherent with confined spaces are typically to the safety of workers when oxygen deficient or toxic atmospheres occur. It may also be difficult to enter and exit from confined spaces, compounding the risk.

In addition to confined spaces, accidents resulting in injury can also occur while accessing the ship through poorly marked entry and exit routes, poor lighting and poor ventilation.

Typically current practice at ship recycling yards in India, Pakistan and Bangladesh not give due consideration to these issues. Routes of entry and exit are not routinely marked and confined space training and equipment is limited.

1.2 Justification

Safe access to a structure is fundamental to safety of the workers, especially with ships where there are many poorly lit areas and confined spaces. In addition, especially at the outset of recycling works, routes into and within the ship may not be well known or marked.

Furthermore, the ability to locate the direction of the nearest safe exit quickly is important for escape from an unexpected incident (e.g. fire) or to affect a rescue.

1.3 Findings from Research

Research during the desk study coupled with information gathered from the site visits demonstrated that the current practice in yards did not allow sufficient time for entry and exit routes to be planned and implemented before workers entered the ships.

Site visits showed that some yards at the Alang site in India, do have workers in charge of confined space entry, however this was not the case at all yards, especially in Bangladesh.

1.4 Aim of the Proposed Solution

The aim of the proposed solution is to prevent accidents by making entry and exit routes safer, highlighting the risks of working in confined spaces and suggesting ways these can be eliminated, avoided or reduced.

2.0 TRANSITIONAL TECHNOLOGY SOLUTION

2.1 Technical Description

2.1.1 Access and Exit

When a ship arrives at a recycling yard, safe and clearly marked routes for entry and exit should be one of the first considerations. These routes should be kept clear at all times.

It is often the case at sites that there is little or no lighting within a ship. Poor lighting can lead to accidents through slips, trips and falls or knocks. It may be possible that the ships' own lighting could be used whilst safe to do so, which could be achieved by using a systematic approach to the dismantling which leaves key electrical circuits in place for as long as possible.

When power is not available an alternative approach is needed. The easiest way to get light into a ship would be to make use of natural light by cutting holes in the side of the ship. The location of these holes is important as they should be:

- In a clean area to avoid hot works in spaces which are not gas free;
- In locations which will not cause a hazard to workers;
- If they are in a place near to where work is to be carried out, they should be clearly marked, and if large, have rope barriers;
- Located in such a way to give an even lighting rather than light/dark areas which can confuse workers' vision and make hazards harder to see, this can be achieved by cutting several small holes rather than a few large ones.

There will be numerous different levels within the ship and, where possible, there should be safe access to each level where work is ongoing. If no internal platform or steps are available, and holes can be cut into the side of the ship with ladders securely fixed, these ladders can then be used for entry and exit, and should be marked on the General Arrangement plan used for indicating safe access/egress routes.

Routes will change depending on the work that is being carried out. Any changes must be clearly disseminated to workers and new routes marked out. A daily work plan, comprising of a large scale General Arrangement plan signposted at the recycling yard, would need to be updated to reflect any changes in routes.

Storage areas for materials should be clearly defined and marked out to avoid debris and material blocking access routes.

When accessing the vessel account should be taken of Guidance Note on Working at Heights.

2.1.2 Confined Spaces

A confined space includes any chamber, tank, vat, silo, pit, sewer, flue, well or other similar space that, by virtue of its enclosed nature, poses a foreseeable, specified risk to those entering it.

Supervisors must be trained on what constitutes a confined space and what the dangers are. When a ship arrives at the recycling yard, then those trained should survey the ship to clearly mark all potential confined spaces on both the actual ship as well as its general arrangement plan. Clear pictorial instructions should be used to indicate that only trained personnel should enter these confined spaces. All workers should then be informed in toolbox talks[1] why they are not to enter these spaces unless they have received training and what the consequences could be.

When entry to a confined space is needed, an entry plan must be drawn up. Ideally the plan should include:

- Testing the atmosphere for oxygen levels before and during entry;
- A description of the work to be carried out. All workers should be aware of this to reduce time spent in the area; and,
- A rescue plan where one of the key aspects is that if a worker becomes ill or overcome by fumes, no attempt to rescue by entering the space should be made without breathing apparatus.

Once the entry plan has been drawn up a “permit to enter” could be issued by the supervisor or other suitably trained person. This should be valid for no more than a day and should be kept at the entrance to the confined space. All workers need to be made aware that no entry to confined spaces is allowed without a valid “permit to enter”

2.1.3 Near Misses

An important procedure for the prevention of accidents is the reporting of near misses, where a near miss is an unplanned event that did not result in injury, illness, or damage but had the potential to do so. If such near misses are reported, and the causes of the near miss acted on, it can contribute to the prevention of an accident happening.

Near misses could be either reported to a nominated safety officer or other appointed person, verbally or in writing, with the option to remain anonymous if chosen. The safety officer would then report the near miss to the work supervisors on a regular basis, perhaps monthly, so all the near misses reported during that period can be reviewed and action can be taken to resolve the situations if needed.

[1] On-site, brief, training using visual and practical techniques

2.2 Resource Requirements

In addition to the extra personnel resources required to survey the ship on reception at the recycling yard, the only other main resource requirement would be a financial outlay to acquire equipment for testing for oxygen on a very basic level. This would need to be equipment that does not require calibrating as it would be difficult to ensure calibration, and would need to be able to withstand a muddy, dusty environment. The cost for such oxygen testing apparatus would be less than $250, procured locally

Furthermore, breathing apparatus would need to be made available for rescue operations. This can be either purchased locally or contact to local fire stations may provide an opportunity to purchase used equipment.

Time would be needed to train supervisors and plan before confined space entry is attempted where toolbox talks would be the best method of training.

2.3 Risk to Human Health and Environment

The risks to human health from confined spaces include:

- Suffocation due to low oxygen levels;
- Explosive gas mixtures forming and being ignited; and
- If a worker is injured while in a confined space rescue can be difficult and prolong the time to treatment being received.

Ultimately, accidents and incidents involving confined spaces can lead to the injury or death of several workers in one incident.

Insufficient or inappropriate entry and exit routes can lead to injury and death through slips, trips and falls, as well as falls from height. These are covered in Guidance Note – Working at Heights.

3.0 IMPLEMENTATION OF SOLUTION

The proposed solutions provided in this guidance note will require further work to develop into full guidance documentation to the benefit of the ship recycling operators and workers.

As such, the following section offers recommendations on how the guidance could be implemented by the operators and workers.

3.1 Proposed Format for the Guidance Documents

We would envisage that the guidance documentation should contain a checklist, with pictures used wherever possible, to advise the survey team on the identification of confined spaces and requirements for establishing safe access and egress routes. There could be diagrams explaining what confined spaces may typically be present and how these may result in hazardous situations arising. In addition the documentation would suggest methods for cordoning off the hazardous areas of a ship, normally using simple ropes.

Sample toolbox talks can be used to demonstrate how these issues can be disseminated to the workers at the recycling yards.

It is recommended that a large diagram (General Arrangement) of the ship should be signposted at the recycling yard, this showing:

- Safe entry and exit routes;
- Emergency exit routes;
- Storage areas for equipment/materials; and
- Areas which are classified as a confined space, and must not be entered.

This will need to be very clear and all workers must understand the meaning, so either the information is pictorial or in the relevant languages for the workers at the site. The diagram will change on a daily basis as the ship is dismantled, so these changes need to be kept up to date and communicated to the workers.

As part of the guidance documentation, a checklist needs to be drawn up for confined space entry, including:

- Check atmosphere is free of gas (including how work to be carried out may affect the atmosphere);
- Plan of entry and exit;
- Emergency rescue plan;
- Checks on personnel to ensure they are trained; and
- Workers should also know how to use and implement a “permit to enter” system.

3.2 Barriers to Implementation

The barriers to implementing this solutions are low and will be changing current practices and convincing shipyard owners and workers alike of the dangers and need for change.

3.3 Overcoming Barriers to Implementation

‘Ambassadors’ who are aware of the dangers and the need for change would need to work with others who are less aware. In this way awareness can be raised of the risks.

All training should use pictures as far as possible. Where text has to be used it should represent all languages used for communication at the site.

If equipment is purchased, someone must be tasked with keeping it in working order, and be trained in how to do so.

3.4 Proposed Training Schemes

It is suggested that there should be a dedicated team of 3 or 4 workers tasked with identifying and subsequently entering confined spaces. These workers should undergo in-depth training lasting at least 2 days on procedures for entry and how to reduce risks.

More general training should be given before any worker starts on site, followed by annual half-day refresher courses. This should cover identifying hazardous confined spaces and should emphasise the dangers of workers entering such confined spaces.

Practical toolbox talks should be held on a regular basis. The topic for these could be suggested by the workers or based on any near misses which may have occurred during that month.