BASEL CONVENTION

Technical Guidelines for the Environmentally Sound Management of the Full and Partial Dismantling of Ships

Secretariat of the Basel Convention

UNEP

Technical guidelines for the environmentally sound management of the full and partial dismantling of ships

Published in 2003

Sales no. E.03.III.D.22

ISBN : 92-1-158620-8
ISSN : 1020-8364

Printed in chlorine-free cyclus paper

This Publication is available from:

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CH-1219 Châtelaine, Switzerland

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BASEL CONVENTION

BASEL CONVENTION
ON THE CONTROL OF TRANSBOUNDARY MOVEMENTS OF
HAZARDOUS WASTES AND THEIR DISPOSAL

SECRETARIAT

Technical Guidelines for the Environmentally Sound Management of the Full and Partial Dismantling of Ships

Basel Convention series/SBC No. 2003/2

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1. EXECUTIVE SUMMARY

Background

Current ship breaking is centred primarily in Pakistan, India, Bangladesh and China. Almost all vessels, with few exceptions, are broken up at beach facilities. Compared with standards or general norms expected within the industrialised countries, current methods of ship dismantling fail to comply in many aspects. Insufficiencies related to the adopted procedures include, but may not be limited to precautions, training and awareness and to facilities available. Furthermore, the implementation of measures for improvement will affect not only the ship-dismantling facility but may also raise issues relating to procedures prior to dismantling, as well as to the destiny of the waste or material streams derived from the extraction process.

Problems generated by the insufficiencies of current ship-dismantling practices have consequences for not only the environment but also for occupational safety and health of the workers.

Environmental impacts can be categorised as follows:

- By occupying and expanding the areas required for breaking, the dismantling industry affects both the local surrounding, environment and society. The established local community may be relying on basic industries such as fishery and agriculture, hence conflict of interests may become an issue.

- Discharges and emissions to sea, ground and air cause both acute and long term pollution. The lack of containment to prevent toxins from entering the environment is a major concern.

In recognising the need for improving the process and further, to manage the increasing volume of vessels to be disposed, the Conference of the Parties to the Basel Convention on the Control of Transboundary Movement of Hazardous Wastes and their Disposal (Basel Convention) decided to address the subject at their fifth meeting (COP 5) in December 1999.

The Technical Working Group of the Basel Convention was instructed to initiate work on the development of Technical Guidelines for the Environmentally Sound Management of the Full and Partial Dismantling of Ships. Further, the Technical Working Group was instructed to provide a list of hazardous wastes and substances under the Basel Convention applicable to ship dismantling.

The guidelines

This document, the *Technical Guidelines for the Environmentally Sound Management of the Full and Partial Dismantling of Ships* (hereafter referred to as “the guidelines”), has been prepared with the intention of providing guidance to countries which have or wish to establish facilities for ship dismantling. The guidelines provide information and recommendations on procedures, processes and practices that must be implemented to attain Environmentally Sound Management (ESM) at such facilities. The guidelines also provide advice on monitoring and verification on environmental performance.

In accordance to the Basel Convention, ESM is defined as:

"Environmentally sound management of hazardous wastes and other wastes" according to Article 2, paragraph 8 means *"taking all practicable steps to ensure that hazardous wastes or other wastes are managed in a manner which will protect human health and the environment against the adverse effects which may result from such wastes".*

Workers' safety is also threatened by the lack or absence of basic precautions. Due to the lack of a guiding norm when decommissioned, allowing preparatory actions onboard prior to dismantling, the vessel itself may represent potential risks. Basic risk reducing or eliminating measures are often ignored and ultimately, accidents occur. A lack of co-ordination of working procedures, lacking facilities and the absence of safety control of those available, represent elements of risk. The main concerns related to health include the exposure to harmful substances, insufficient sanitary facilities, as well as the nature of work operations (hard manual labour involving heavy lifting, etc.). General exposure of pollutants originating from the ship dismantling facility is also a health concern for the people living in the immediate vicinity of the site. Both workers and the local society are potentially exposed to carcinogens and other harmful substances such as PCB, PAH, heavy metals and asbestos. The adverse effects of exposure to these substances are relatively well known. Their health impact is severe and can be passed on to the following generations.

These Guidelines do not currently address measures to minimise the hazardous materials aboard a ship prior to it being sent to a ship recycling facility. However, Basel Convention Parties believe that such waste minimisation guidelines are an important part of addressing the problems associated with ship recycling. IMO/MEPC are addressing this and related issues. They have plans for the short and long term actions.

Further, these Guidelines do not deal in depth with the occupational health and safety aspects of ship recycling. The International Labour Organization has undertaken an effort to prepare such guidelines. Once developed, those guidelines may be incorporated herein.

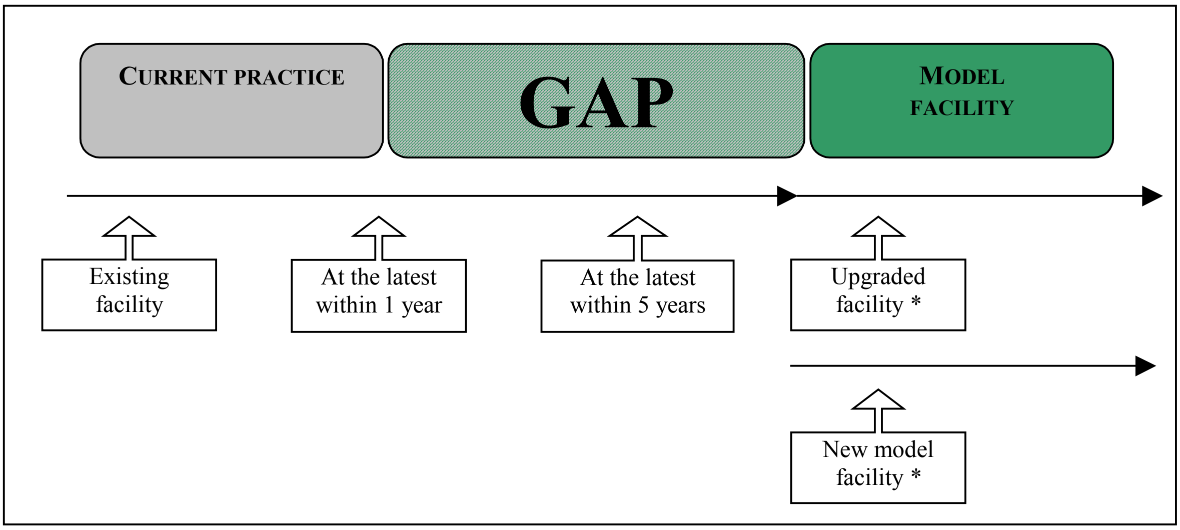
The UNEP Division of Technology, Industry and Economics (UNEP/DTIE) has been requested by the Secretariat of the Basel Convention (SBC) to consider the possibility of initiating joint work on the preparations of guidance materials for downstream recycling operations following the dismantling of ships.

Issues addressed are limited to the technical and procedural aspects of ship dismantling. It is understood that the legal questions regarding the export of ships as hazardous waste still need to be examined by the Legal Working Group of the Basel Convention.

The application of the guidelines

The guidelines are applicable to existing ship dismantling facilities as well as to new facilities.

The reference to **current practice** is applied as a starting-point for existing facilities in a planned process of implementing the principles of ESM. This process reflects gaps between current practice and a **model facility**. New facilities are expected to comply with the identified model facility standards.



* From the adoption of these Guidelines.

Figure 1 below provides an overview of the elements to be considered in order to achieve an environmentally sound ship dismantling facility. The technical and operational procedures that must be implemented constitute an Inventory of Best Practices for ESM of a ship-dismantling yard.

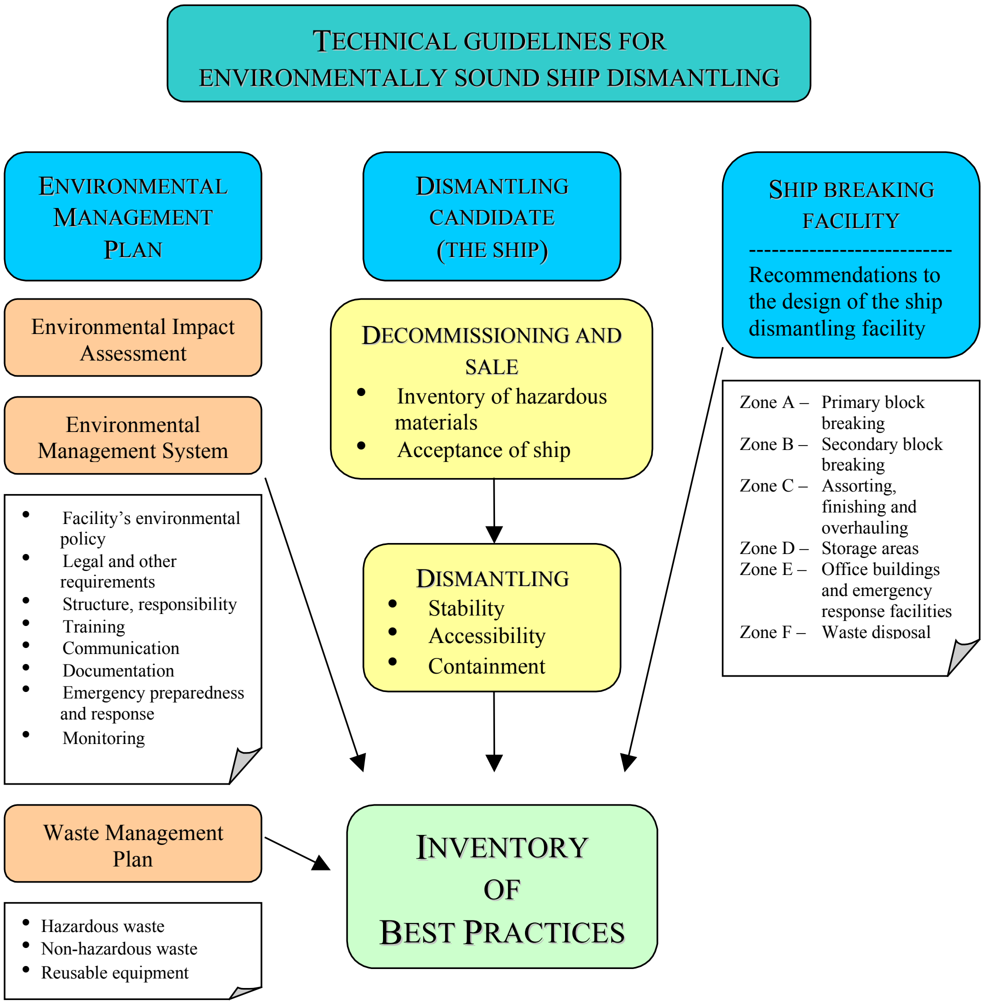


Figure 1 Overview of elements to consider for ESM of a ship dismantling facility

Preparations on the ship

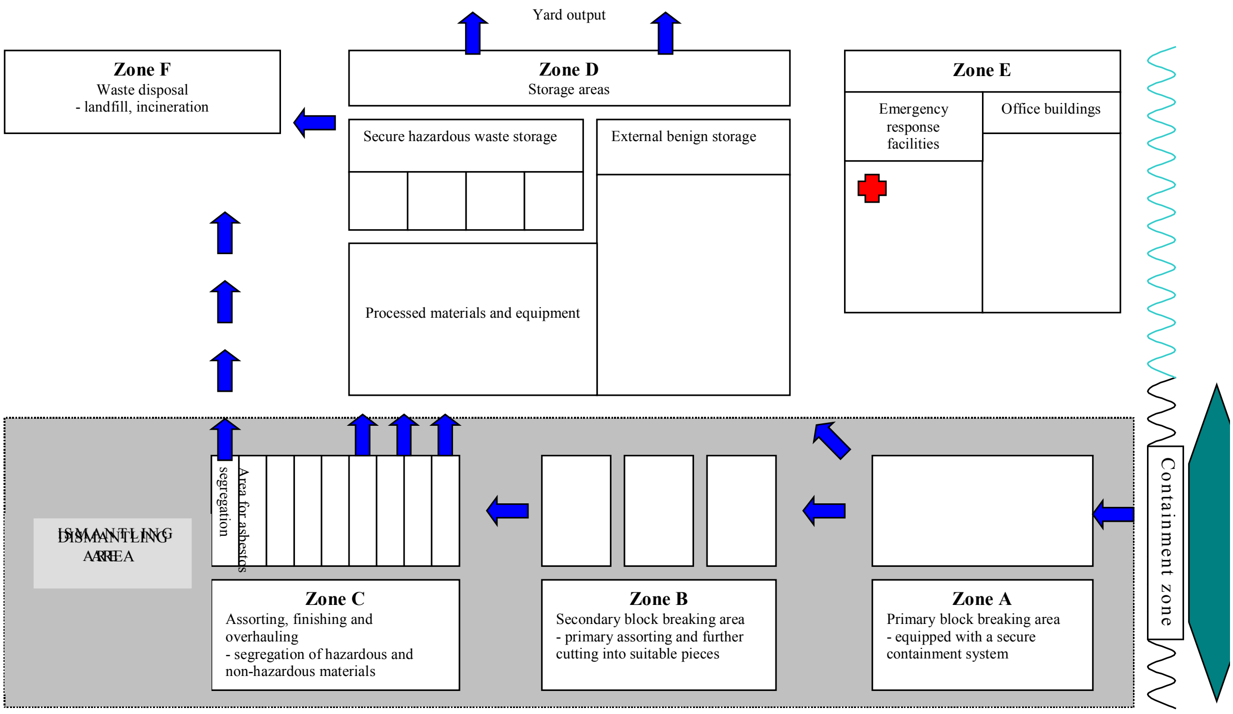
There are some preparatory procedures that should be implemented on the vessel prior to its voyage for dismantling:

- *Preparation of an* ***inventory list*** *of* on board *hazardous/ polluting wastes;*
  An inventory survey of the vessel should be carried out where the types of hazardous wastes and other wastes on board are identified, quantified and located. A thorough vessel survey can also be applied for the purpose of planning the sequence and nature of the work to be executed.
- *Removal/ cleaning– liquids, including fuels and oils;*
  Hazardous wastes and materials such as asbestos, PCBs and TBT paints should, to the extent possible, be removed in best available facilities from the ship during its life cycle prior to its voyage for dismantling so that a minimal amount of this material will have to be dealt with during the breaking process. Prior to cutting, the ship should be cleared of all residual materials. This may be carried out prior to arrival or at a cleaning station at the facility. Cleaning of i.a. cargo tanks, bunker and fuel tanks, bilge and ballast compartments, sewage tanks, etc. should be performed in order to ensure that the ship is presented for dismantling in a clean and safe condition. This process will continue during the entire dismantling process.
- *Securing;*
  To ensure that working procedures and operations are undertaken in a safe manner, a process of securing the vessel is required. There are especially two aspects that should be emphasised; 1) Safe access to all areas, compartments, tanks, etc. ensuring breathable atmospheres, 2) Safe conditions for hot work, including cleaning/ venting, removal of toxic or highly flammable paints from areas to be cut, and testing/ monitoring before any hot work is performed.
- *Removal of equipment;*
  Consumable and loose equipment is removed first. Reusable components are removed as they become accessible. Fixtures, anchors, chains, engine parts and propellers are examples of components that are removed during this step.

Ship dismantling facility – model facility

A model ship-dismantling yard will comprise certain key functionalities:

- *Containment;* Ships contain hazardous materials and no cleanup can remove 100% of these. Spills, leaks and releases will occur. Therefore, the most important environmental design aspect of any ship dismantling yard are measures to contain releases to within the confines of the yard and then collect the spilled or released materials.
- Workstations for secondary dismantling and sequential breakdown into component elements
- Hazardous and toxic materials removal requires specially equipped workstations including the provision of appropriate containment
- Temporary storage areas for benign materials and steelwork
- Secure storage areas for hazardous wastes
- Storage areas for fully processed equipment and materials that are ready for reuse, recycling or disposal
- Proximity to proper disposal facilities (including POPs (persistent organic pollutants) destruction facility in accordance with Stockholm Convention destruction criteria)



Above is a conceptual layout of a model ship-breaking yard. Sub-division in zones is relevant for the design of a model facility. For an environmentally sound design of a yard, it is important to discern which activities take place in which zone, and which associated hazards are to be considered and prevented through sound design. A presentation of the activities that would take place within each zone and the associated environmental, health and safety hazards is given here:

Zone	Activities	Environmental hazards	Health & safety hazards
Containment zone	- Initial containment	- as in column below	- as in column below
Zone A Primary block breaking area	- Removal of oil (sludge) and fluids - Dismounting of re-useable equipment - Cutting of large ship segments - Removal of asbestos and batteries - Emptying fire extinguishing systems, and CFCs from cooling systems	- Oil and fuel spills - Bilge and ballast water spills - Paint and coatings - Heavy metals - PCB - Others *	- Asbestos - Vapours (solvents and metals) - CO_2 - Risk of explosion - Radiation
Zone B Secondary block breaking area	- Primary sorting of components - Further cutting into suitable size for further transport	- Paint and coatings - PCBs - Others *	- Asbestos - Vapours - Risk of explosion
Zone C Assorting, finishing and overhauling areas	- Definitive sorting of materials and equipment - Segregation of composite materials - Finishing of materials for re-sale - Overhauling of equipment	- Oil and fuel spills - PCB - Others *	- Asbestos - Vapours

Zone D Storage areas	- Stockpiling of assorted, finished materials	- Oil and fuel spills - PCB's - Others *	- Asbestos - Risk of explosion
Zone E Office buildings and emergency facilities	- Administrative work - First Aid help (if not dealt with on the spot)		
Zone F Waste disposal facilities	- Landfilling - Incineration - Wastewater treatment	- Seepage of toxic liquids	- Toxic liquids - Asbestos

* "Others" represent i.a. anodes, radiation sources, heavy metals, TBT, batteries and freon.

Environmental Management Plan

The successful establishment of ESM for a ship-dismantling facility requires the establishment of an Environmental Management Plan (EMP). This includes the initial step of assessing the potential environmental impacts from the facility by performing an Environmental Impact Assessment (EIA). The EIA helps to identify the environmental aspects and the environmental goals to be set for the facility, and serves as an input to the Environmental Management System (EMS).

The EMP would be an all-encompassing document covering all environmental issues at a macro-scale:

- the assessment of potential impacts (EIA)
- the formulation of potential preventative measures (Inventory of Best Practices)
- an environmental management system (EMS), including:

  - waste management plan (WMP)
  - contingency preparedness plan (CPP)
  - monitoring plan (MP)

An EMS encompasses many elements that are helpful for improvement of the environmental performance:

1) Identification and prioritising *environmental aspects*
2) The *environmental policy* should include a commitment to continual improvement and prevention of pollution
3) Environmental *objective and targets* for each function and level in the organization
4) *Environmental management programme,* including the responsibility, means and time-frame for achieving the objectives and targets, as well as training and awareness of the workers
5) *Operational control & procedures;* All operations and activities associated with environmental aspects must be identified, and procedures that cover situations that could lead to deviations from the environmental policy are established and maintained (e.g. procedures for waste management, contingency preparedness, and environmental monitoring).
6) *Checking and corrective action;* monitoring and measurements are carried out in order to record actual environmental performance and conformance with the objectives and

targets laid out in the environmental policy as well as compliance with relevant environmental regulations. Record keeping. Environmental audits.

The management of waste is the planned and controlled extraction, sorting and transport of the waste stream derived from the dismantling process. The hierarchy of approaches in waste management in its simplest form can be described as follows:

- Prevention: the first priority in waste management should be to prevent waste generation. This should be a major priority
- Recycling: the non-hazardous waste that is produced after implementing prevention measures should be re-used or recycled as far as possible
- Disposal: if prevention and recycling are not possible the waste should be disposed of in a controlled manner, and in accordance with international law

The waste management procedures will be a part of the EMS.

Implementation of best practices – closing the gap

All ship dismantling should comply with the principles of ESM. It has become evident that current practice does not. The gap between current practice and ESM-compliance requires measures at many levels.

The upgrading of existing dismantling facilities can be achieved by applying a stepwise improvement approach. The sequence of actions to be implemented should reflect their impact with respect to human health and the environment. However, it is considered not possible to conduct implementation in accordance with such priorities only. For new facilities, only full and immediate compliance is acceptable.

A first step towards ESM can be taken at a relatively low cost, suggesting that some low investment actions represent a substantial environmental improvement. It may be difficult to implement all identified recommendations at an initial stage due to lack of funding, the need for training and awareness raising, as well as the establishment of necessary legal/ regulatory frameworks. The impact of medium- and long-term actions may justify a higher level of priority, but implementation barriers as outlined above may not allow this. It is nevertheless essential that Parties are determined to fulfil all implementation goals to close the gap as soon as possible.

The actions are separated into physical and operational measures. Operational measures include procedures and practices at the facility, whereas physical measures essentially concern the provisions at the facility (equipment, layout, etc.). Some measures are difficult to classify as operational or physical.

Actions that realistically may be implemented immediately or within a short timeframe, one year, include mostly operational measures and low-cost physical measures, such as the provision of personal protective equipment (PPE), in addition to training and awareness building (which should be a continuous activity). Interim monitored safe and secure storage of hazardous wastes must also be considered a short-term necessity. Medium-term actions should be implemented within a timeframe of five years.

The long term actions are mostly the realisation of physical needs for environmentally sound dismantling of ships, such as:

- Impermeable floors for full ship containment at any stage in the dismantling process
- Removal of asbestos by high standards (vacuum decontamination unit)
- Landfill with adequate environmental protection
- Waste water treatment facility

Some of the actions to be implemented during the process of closing the gap and reaching ESM-compliance are presented in Figure 2.

Governments can secure that steps will be taken by laying down the stepwise approach and the timeframe as an obligation in the permit for the breaking yard.

Figure 2 Stepwise upgrading of existing ship dismantling facility

<table>
<tr><th>At the latest within 1 year</th><th>At the latest within 5 years</th><th>At the latest within 10 years</th></tr>
<tr><td>Spill cleanup procedures</td><td rowspan="10"></td><td rowspan="15"></td></tr>
<tr><td>Ship inventory of hazardous materials</td></tr>
<tr><td>Hot work certification</td></tr>
<tr><td>Cleaning and testing before dismantling</td></tr>
<tr><td>Hazardous waste storage</td></tr>
<tr><td>Fire fighting equipment</td></tr>
<tr><td>Basic personal protective equipment</td></tr>
<tr><td>Appropriate protective equipment against respiratory hazards</td></tr>
<tr><td>Segregation and collection of waste</td></tr>
<tr><td>Asbestos handling procedures</td></tr>
<tr><td colspan="2">Adequate transfer operations facilities</td></tr>
<tr><td colspan="2">Spill containment equipment</td></tr>
<tr><td colspan="2">Adequate stormwater discharge facilities</td></tr>
<tr><td colspan="2">Special respiratory protective equipment for paint removal operations</td></tr>
<tr><td colspan="2">Improved asbestos removal facilities (enclosed chamber, limit access, filter air emissions, decontaminate workers)</td></tr>
<tr><td colspan="3">Adequate draining and pumping equipment</td></tr>
<tr><td colspan="3">Provide adequate treatment/ disposal facilities for the different hazardous materials</td></tr>
<tr><td colspan="3">Spill cleanup equipment</td></tr>
<tr><td colspan="3">Separate area for paint removal operations, with impermeable floor. Cover, isolate area, and ventilate. Install proper air filtering system.</td></tr>
<tr><td colspan="3">Create a dedicated area for segregation of hazardous materials (e.g. PCBs)</td></tr>
<tr><td colspan="3">Complete containment for all ship dismantling activities</td></tr>
<tr><td colspan="3">Removal of asbestos by high standards (vacuum decontamination unit)</td></tr>
</table>

On a general basis there are certain legal and institutional conditions that also must be met to achieve ESM of hazardous wastes. These include:

- a regulatory and enforcement infrastructure ensuring compliance with applicable regulations
- authorisation of sites or facilities ensuring an adequate standard of technology and pollution control to deal with hazardous wastes
- enforcement capability ensuring appropriate action taken in cases where monitoring reveals non-compliant management of hazardous wastes or resulting unacceptable emissions

The realisation of these conditions lies outside the scope of these guidelines, but it is obvious that without regulation it is not very likely that the existing situation will improve.

2. INTRODUCTION

2.1 Objectives

The intention of these Technical Guidelines for the Environmentally Sound Management of the Full and Partial Dismantling of Ships is to provide guidance to countries which will hold facilities for ship dismantling.

The primary objective of these guidelines is to enable a ship-dismantling facility to attain Environmental Sound Management (ESM) by providing information and recommendations on procedures, processes and practices.

The guidelines also provide recommendations regarding the implementation of the advised procedures, processes and practices, as well as on monitoring and verification of performance.

2.2 Background

Tightening environmental regulations resulted in increased costs of hazardous waste disposal in industrialised countries in the 1980's. Subsequently, this led to "toxic traders" exporting hazardous waste to developing countries where environmental regulations were less stringent. International outrage at the discovery of these activities led to the implementation of the 1989 Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal (Basel Convention under the administration of UNEP).

At the onset, the Convention was primarily devoted to setting up a framework for controlling transboundary movements of hazardous wastes, and to develop criteria for "Environmentally Sound Management".

Ships are mobile structures of comprehensive size and consist mostly of steel. At the end of their active life, they become a sought-after source of ferrous scrap. This acts as an alternative to the non-renewable resource of ore and is particularly suited for the production of simple steel products. Obsolete vessels available for scrapping may also represent a useful source of supply for second hand equipment and components.

The very nature of vessels represents risks both to the environment as well as to general safety aspects in the dismantling context. The considerable dimensions, their mobility and the presence of materials and substances, both those integrated in the structure as well as those required for operation, are all factors contributing to such risks.

The established regulative regime governing international shipping covers the stages of design/ construction, operation and maintenance and identifies minimum standards and norms for compliance. However, the established maritime legislative infrastructure does not take into account the final stages of a vessel’s life, namely its retirement. Consequently, there are at present no international regulatory standards relating to shipbreaking. As a result of this inconsistency, practices and procedures for decommissioning and dismantling, which are in grave breach of basic environmental and human health protection norms, have been adopted in many countries.

Resource recovery

Most of the material stream, sometimes referred to as the waste stream, generated from the dismantling process can be put to good use in a significant way. Usable equipment and components; electrical devices (radios, computers, televisions, etc.); life-saving equipment (life buoys, survival suits, rafts, etc.); sanitary equipment; compressors; pumps; motors; valves; generators; and so on, can all be re-used for alternative applications and the scrap steel structures are re-processed. Steel production from scrap in comparison to that of ore, offers a considerable saving in energy consumption. In this perspective, shipbreaking may be claimed to comply with the principles of sustainability even though there may be some discrepancy between area of application. Unfortunately, procedures adopted in extracting and re-generating, do not.

Adopted practice – implications

Most ship-breaking today takes place at beaching facilities in Pakistan, India, Bangladesh where the vessels are beached under their own power in the conveniently wide inter-tidal zone (more on this in chapter 3.4). Insufficiencies related to current procedures include but may not just be limited to precautions, facilities, training and awareness. Furthermore, the implementation of measures for improvement will affect not only the ship-dismantling facility but may also raise issues relating to procedures prior to dismantling, as well as to the destiny of the waste or material streams derived from the extraction process.

Problems generated by the insufficiencies of current ship-dismantling practices have consequences for not only the environment but also for occupational safety and the health of the workers.

The environment

Environmental impacts can be categorised as follows:

- By occupying and expanding the areas required for breaking, the dismantling industry affects both the local surrounding environment and society. The established local community may be relying on basic industries such as fishery and agriculture, hence interests of conflict may become an issue.
- 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 is a major concern and represents a general threat to all living creatures.

Occupational safety

Workers' safety is threatened by the lack or absence of basic precautions. Due to the lack of guiding norms regarding preparatory onboard actions prior to dismantling, the vessel and onboard systems may themselves represent potential risks. An example may be that of ensuring breathable atmospheres in enclosed spaces where workers will enter. Basic risk reducing or eliminating measures are often ignored and ultimately, accidents occur.

A lack of co-ordination of working procedures, lacking facilities and the absence of safety control of those available, represent elements of risk which potentially can cause bodily harm and injuries.

Health

The main aspects of concern related to health include the exposure to harmful substances, as well as the nature of work operations (hard manual labour involving heavy lifting, etc.).

In addition, concerns include housing located in the immediate vicinity of the dismantling facility, insufficient sanitary facilities and general exposure to contaminants from the site due to discharges in the sea, the soil and the air.

Both workers and the local society are potentially exposed to carcinogens and other harmful substances such as PCB, PAH, heavy metals and asbestos. These substances may be present in most vessels. The long-term effects of sustained exposure to these substances are relatively well known. Their health impact is severe and can be passed on to following generations.

The ship-dismantling procedures

The decommissioning process is initiated by the decision to sell a vessel for disposal (scrapping). Stages involved in the process are illustrated in Table 1. The Technical Guidelines for the Environmentally Sound Management of the Full and Partial Dismantling of Ships contain recommendations concerning *measures* of both a technical and procedural nature with reference to the stages II and III (shaded in the table below).

Table 1 Ship-disposal processes

	SHIP DECOMMISSIONING FOR DISPOSAL STAGES		
	I OFFSHORE/ AT ANCHOR	II INTERTIDAL ZONE/ DOCKING FACILITY	III IN-LAND/ PORT
	Decommissioning and sale	**Demolition – principles of the dismantling process**	**Sorting for re-use, recycling and disposal**
The process involved	**Ship for disposal***	**Sectional demolition**	**Extraction and sorting**
Actions/ events	**At scrapping location** 1. Onboard ship-generated waste 2. Inventory of hazardous substances Required minimum draught; 3. Required maximum discharge (ballast water, bilge and tank residues)	**Beach, quay or docking facility** 4. Contain releases 5. Secure stability of ship Section dismantling; 6. Prevent expl./non-breathable atmosphere + unintentional release of gas/chemical, secure easy access Cutting, debris, falling modules, transport to sorting and storage	**Dismantling, sorting and storage facility** 7. Sorting, storage of; liquids/ solids/ hazardous wastes, flammables, explosives 8. Cutting, burning (e.g. cable copper extraction) 9. Transport
Measures	Standards/ norms for decommissioning for scrapping/ disposal	Standards/ norms, facilities (Technical)	Standard norms – operational (Procedural)
		Standard norms – operational (Procedural)	Standard norms, facilities (Technical)
Stakeholders	IMO, flag states, national/ local authorities, shipowners, classification societies, ship scrappers, NGOs	UNEP, ILO, national/ local authorities, ship scrappers, NGOs	UNEP, ILO, national/ local authorities, NGOs

* A uniform standard to which the ship should comply with regards to preparative actions taken prior to dismantling is expected to be developed by IMO.

It should be noted that the MARPOL Convention regulates ship generated wastes as referred to in Table 1 (item 1) and require waste reception facilities to be provided by the port state. This is further discussed under chapter 3.4.1.

2.3 Stakeholders

Stakeholders and their principle area of involvement are indicated in Table 1.

United Nations Environment Programme (UNEP)

In the Basel Convention, legal questions regarding the export of ships as hazardous wastes still need to be examined by the Legal Working Group. These guidelines are limited to the technical and procedural aspects of ship dismantling.

The Conference of the Parties decided to address the subject of the dismantling of ships at their fifth meeting (COP 5) in December 1999. Following this, the Technical Working Group of the Basel Convention was instructed to initiate work on the development of Technical Guidelines for the Environmentally Sound Management of the Full and Partial Dismantling of Ships. Further, Technical Working Group was instructed to provide a list of hazardous wastes and substances under the Basel Convention applicable to ship dismantling.

At the 17th session of the Technical Working Group (held in Geneva on 9-11 October 2000) it was decided to address items concerning workers' conditions as follows;

"*Health and safety is addressed by adding the identification of workers safety and health hazards to an item under point 4.4. Detailed guidelines should be worked out by other organizations than the Basel Convention. ILO should be invited to undertake this task*".

These guidelines make provisions for the proper removal of hazardous wastes and substances, including the collection, sorting and disposing/ recycling of wastes in an environmentally sound manner. It should be noted that these guidelines do <u>not</u> concern the subjects of health and safety. Some aspects of health and safety will be addressed because of their relevance to specific environmental aspects, but not in any depth.

International Maritime Organization (IMO)

IMO is a UN agency seated in London. The subject of disposal by dismantling (scrapping) was brought to IMO's Marine Environmental Protection Committee (MEPC) in 1998 when it was proposed (by Norway) to adopt the topic to IMO's agenda (MEPC 43/18/1). The report from the MEPC session (MEPC 43) includes the following reflections;

"After an extensive exchange of views, the majority of the delegations who spoke supported the inclusion of ship scrapping in the work programme of the Committee. Recognizing the divergence of views and that more information on how to deal with this complicated issue would help the Committee to make a decision, the Committee decided to include the item of Ship Recycling in the agenda of MEPC 44 and invited Norway and other interested Members to provide more information to the next session of the Committee particularly on how this matter should be handled by IMO".

Response to the invitation was received from a number of nations as well as from NGOs and was debated at the follow-up meeting (MEPC 44):

- The Committee was informed on the UNEP initiative (fourth UNEP *Ad Hoc* Committee for the implementation of the Basel Convention) where the Parties gave a mandate to the

Technical Working Group of the Basel Convention to collaborate with IMO on the subject in order to prepare guidelines for environmentally sound management on the dismantling of ships and to discuss related legal aspects with the Consultative Sub-group of Legal and Technical Experts of the Basel Convention (ref.: MEPC 44/INF.22)

- The Commission on Sustainable Development called on IMO and encouraged States to ensure that responsible care is applied to the disposal of ships
- Reference was made to resolution MEPC.53 (32) on the development of the capacity for ship scrapping for the smooth implementation of the amendment to Annex I of MARPOL 73/78 recommending that Member Governments (in particular those involved in shipbuilding and shipping industries) take initiatives together with the shipbuilding and shipping industries to:

    - Develop ship scrapping facilities at world-wide level and to promote research and development programmes to improve efficient scrapping techniques
    - Establish adequate ship-scrapping facilities as soon as practically possible
    - Provide technical assistance and transfer of technology to developing countries in their efforts to develop ship scrapping facilities

Discussions during MEPC 44 revealed a general agreement that IMO has an important role to play in reducing the environmental and safety risks associated with the disposal of vessels. The Committee agreed to consider the matter further at MEPC 46 and decided to establish a correspondence group (CG) to facilitate the discussion. The CG reported to MEPC 46 and confirmed:

- deficiencies in national regulations on the issues of environmental concerns, occupational health and workers safety, and furthermore on the enforcement of standards
- lack of an international governing frame for ship-recycling practices

Furthermore, the CG requested the Committee to note the group's view on the perceived roles of involved agencies and bodies and to consider future work in the light of recommendations provided. The perceived responsibilities as suggested are listed below:

Agencies and bodies	**Perceived role**
International Maritime Organization (IMO)	Overall responsibility for co-ordinating issues associated with ship-recycling and responsibility for monitoring issues arising during ship design, building and operation which may have an impact on recycling, including preparations for recycling on board.
International Labour Organization (ILO)	Responsibility for establishing standards of operation in shore-based industries involved in ship-recycling, concentrating on considering the application of its already existing standards and recommendations to ship-recycling and developing guidance for the ship recycling industry in these and other areas - to take the lead on working conditions in and around vessels once they have been beached.
United Nations Environment Programme (UNEP)	*The Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal* – recognising the limited application of the Convention to the vast majority of ships which are recycled, to concentrate on the identification and safe handling/disposal of hazardous wastes and on reducing the use of materials which generate such wastes.
The 1972	Continuing to monitor the disposal of ships at sea and encouraging recycling as

London Convention	the preferable option. London Convention Scientific Group has developed criteria to assess ships for disposal at sea.
The Shipping Industry	Has prepared an "Industry Code of Practice on Ship Recycling" that includes an "Inventory of Potentially Hazardous Materials on Board". Continues to seek endorsement of and comments on its work from MEPC at regular intervals in the future, and works with Classification Societies in improving plans to decommission ships in a safe and environmentally sound manner.
Environmental groups	Continuing to monitor and report on ship-recycling issues in a responsible manner.
States	Develop, adopt and enforce, as appropriate, within appropriate international organizations, international standards relevant to ship recycling.

During the discussions at MEPC 46, the following points were made:

a) IMO's main role should be to deal with ships before the recycling process and internationally binding guidelines should be established;

b) IMO should discuss the feasibility of implementation of any guidelines before commencing to write them;

c) IMO should continue to discuss whether it should take on the main co-ordinating role in ship recycling;

d) it was suggested that a draft Assembly resolution for the twenty-third Assembly should be developed;

e) in preparations for the final voyage before recycling, ships should not be rendered unsafe;

f) IMO should discuss preparations for recycling of existing ships;

g) future ship concepts should be developed in order to reduce environment and safety problems in the recycling industry;

h) the Correspondence Group should be re-established concentrating its work on the future role of IMO and where to focus the Committee's attention; and

i) the Correspondence Group should analyse the pros and cons regarding the development of guidelines, binding guidelines, an Assembly resolution, or a new instrument regarding ship recycling.

MEPC 46 in April 2001 re-established the Correspondence Group and renewed its Terms of Reference:

- To identify all stakeholders and their perceived roles during the life-cycle of a ship
- To identify and elaborate on the role of IMO in ship recycling
- To identify the existing international, national and additional industrial and/or other relevant standards/guidelines, which possibly apply to ship-recycling within the role of IMO
- To recommend possible courses of action for further consideration by the Committee, and to identify the pros and cons associated with each option

The group will report to MEPC 47 in March 2002, and a working group is anticipated established at that session, working inter alia with the following questions (subject to confirmation by MEPC 47):

For the short term:

1. the development of technical guidelines and codes of conduct for shipowners and possibly even flag States;

2. assist in the development of a Ship Recycling Technology Programme aimed at improving conditions at the recycling facilities in the current recycling countries. Such a Programme is being developed under the Basel Convention;

3. continue collecting facts and figures on ship recycling.

For the long term:

4. preventive measures through the development of new building techniques and the use of environmentally sound materials; and

5. the development of financial instruments on ship recycling, if this is to be pursued.

International Labour Organization (ILO)

ILO, a UN agency seated in Geneva, has monitored the ongoing work of both IMO and UNEP on the issue of ship scrapping and has been invited to address the issues concerning occupational health and safety. The issue was on the ILO-agenda already in the late 1980s but was not actively pursued.

The 279th session of the ILOs Governing Body (November 2000) endorsed a conclusion of the Tripartite Meeting on the Social and Labour Impact of Globalization in the Manufacture of Transport Equipment stating that;

" *as a first step, the ILO should draw up a compendium of best practice adopted to local conditions leading to the preparation of a comprehensive code on occupational safety and health in ship-breaking, and that Governments should be encouraged to require ships to have an inventory of hazardous materials on board that is updated throughout the life of the vessel* ".

The Programme and Budget for 2002-2003 identifies the improvement of working conditions at shipbreaking sites as a priority area for extra-budgetary activities. The Programme and Budget goes on to state that ILO will also show how - through the facilitation of social dialogue at the international and national levels - opportunities can be provided for tripartite agreements on occupational safety and health in sectors such as shipbreaking where the social partners can work together to promote decent work.

ILO’s Sectoral Activities Programme includes the development of some publications:

Background Paper on Ship Breaking in Bangladesh (1999)
Is there a Decent way to break up Ships, Discussion Paper (2001)

Workers Safety in the Shipbreaking Industries – An issues Paper (2001)
The ILO has also produced a documentary video, *The Shipbreakers* (2001) and a website: www.ilo.org/safework/shipbreaking.

The main objectives of the ILO involvement in the past have been that of raising awareness focusing on the occupational safety and health issues. The information provided in these publications cover adopted practices, the volume of vessels requiring disposal, scrapping locations, the national distribution of ship operators and the location of the ship building industry (e.g. the identification of the stakeholders). The papers also demonstrate how the initial requirement of developing a compendium of good practice can be met using already existing ILO international labour standards. Although not drafted specifically for ship dismantling, a considerable number of ILO Conventions, Recommendations and Codes of Practice can be applied to deal with numerous occupational safety and health hazards and worker protection in shipbreaking operations (see Appendix C).

ILO will continue its awareness campaign at the national level with an aim to establish a technical cooperation programme that will include practical actions and measures towards the implementation of schemes for "Sustainable ship decommissioning for disposal and recycling". The programme will rest on inputs from the ship dismantling industries, from local and national authorities, as well as from employers' and workers' organizations and other concerned agencies and institutions. ILO has organized national tripartite workshops in Chittagong (Bangladesh) and in Mumbai (India) and a fact-finding mission at the Gadanni Estate (Pakistan). In some cases, these were undertaken jointly with IMO and the Basel Convention. An advisory mission was undertaken to four shipbreaking yards in China in October followed by a tripartite national workshop in Beijing on 19-20 December 2001. These missions, in addition to occupational safety, health and environmental issues - have also identified decent work deficits with respect to freedom of association and collective bargaining, social protection (pensions, sickness, injury and disability benefits and unemployment insurance), welfare provisions, basic living conditions and training - all of which are in need of considerable improvement.

Preliminary research has begun on developing a Technical Guide on safety in the ship-breaking industries (in line with the ILO's code of practice on OSH Management Systems) which would be complementary to the work undertaken in IMO and in the Technical Working Group of the Basel Convention. A draft of the guide will be tested throughout 2002 and finalised in 2003.

The Shipping Industry

The International Chamber of Shipping (ICS) took the initiative to establish the "Industry Working Party on Ship Recycling" (IWPSR) in February 1999. The background for this initiative was the requirement for an industry response to the growing concerns expressed by governments, NGOs and indeed the industry itself on matters of:

- The legal position of vessels sold for recycling
- The conditions and safety provisions for workers in ship-breaking industries.
- The lack of environmental concerns

The IWPSR consists of the following organizations:

Baltic and International Maritime Council (BIMCO)	International. Tanker Owners Poll. Fed. (ITOPF)
Intl. Ass. of Dry Cargo Shipowners (INTERCARGO)	International Transport Workers Fed. (ITF)
Intl. Ass. of Indep. Tanker Owners (INTERTANKO)	Oil Comp. International. Marine Forum (OCIMF)
International Chamber of Shipping (ICS)	

The International Association of Classification Societies (IACS) and the European Community Ship owners' Association (ECSA) are present as observers during meetings of the group.

The primary IWPSR mandate has been to establish an "Industry Code of Practice on Ship Recycling". The code was adopted in August 2001, and includes a form for preparing an "Inventory of Potentially Hazardous Materials on Board". The code encourages owners to adopt a proactive policy on the scrapping issue, and not just a policy confined to issues concerning the vessel and the on board substances.

Environmental groups

A number of environmental organizations, at a national as well as an international level, have raised concerns regarding the procedures adopted in ship scrapping and the legal applicability of the Basel Convention to ships-as-waste.

The environmental groups have stressed legal issues with respect to the transboundary movements of hazardous wastes, environmental issues, as well as those concerning occupational safety and health. Organizations have undertaken on-site studies and published several reports including studies from Alang, India, Chittagong, Bangladesh as well as dismantling sites in China and Turkey. The environmental groups have, to a lesser extent, reported on dismantling facilities elsewhere.

Environmental groups remain active also in working to establish global policy to ensure generator responsibility for eliminating hazardous waste at source, environmentally sound management as well as preventing the trade in hazardous waste-ships to developing countries.

Policies on ship disposal

The European Union has recently undertaken a study on the technological and economic feasibility of scrapping vessels in Europe. This work was initiated following suggestions that current disposal procedures were in breach of the 1989 Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal (the Basel Convention).

The US has also reacted by imposing more stringent conditions upon the export of government owned ships for recycling.

These two initiatives may be used to illustrate that:

- The world community hesitates to accept the present procedures of dismantling/ disposing of vessels
- Potential opportunity for job creation in well-established economies is not ignored

A number of governments and NGO's including lobbyist organizations representing the shipping industry and environmental and labor organizations, have demonstrated concerns on the ongoing disposal practices and on the consequences of these.

2.4 Scope of these guidelines

Subjects of environmental concern are often related to issues of workers safety as well as to those concerning their health. The Technical Guidelines for the Environmentally Sound Management of the Full and Partial Dismantling of Ships (hereafter called 'the guidelines'), provide recommendations in context of environmental concern and do not make specific provisions on the aspects of health and safety. Health, safety and the environment are in many areas inter-linked and consequently, some aspects concerning health and safety will be reflected upon, but not in any depth. It is important to note the limitations of these guidelines. The guidelines can however provide as a base for the development of site specific procedures on Safety, Health and the Environment (SHE).

Issues addressed are limited to the technical and procedural aspects of ship dismantling. Some recommendations may make reference to issues subjected to those belonging to stage I as discussed under item 2.2 (see Table 1).

The guidelines apply to both full and partial dismantling. A vessel requiring only partial dismantling, for whatever reason, can be processed in accordance with the provisions of these guidelines. Note however that partial dismantling as a process produces a product different from that of full dismantling. The following requirements apply to the end product of partial dismantling:

- Decontamination: any partial dismantling includes decontamination. It is recommended that the London Convention's criteria to assess ships for disposal at sea and the "Cleanup Standards for Ocean Disposal of Vessels" and the "Cleanup Guidelines for Ocean Disposal of Vessels" developed by Environment Canada, Environmental Protection Branch, February 1998, are considered and adhered to as appropriate (see Appendix C).
- Transportation: any partial dismantling must plan for safe removal and transportation away from the ship-breaking facility.

2.5 Methodology

The adopted approach to meet the scope of the guidelines is illustrated in Figure 3.

Chapters:	2	3	4	5	6	7
Topics:	Status statement		Guidelines and recommendations		Implementation and verification	

Figure 3 Approach to meet the objectives of the guidelines

Status statement

The two introductory chapters define the purpose of the guidelines and identify challenges associated with ship dismantling in the perspective of the principles of the Basel Convention and the concept of *Environmental Sound Management.* To improve understanding of the challenges of environmental sound dismantling of ships, existing practices and standards will be addressed.

Guidelines and recommendation

Chapters 4 and 5 elaborate upon the identified challenges and associated environmental concerns. Both procedural and operational aspects will be assessed and a *good practice* platform will be provided. The recommendations include areas of release/ discharge prevention, monitoring, goals (standards and norms), safety measures, contingency preparedness as well as those related to facility design, construction and operation.

Implementation and verification

In recognising the importance of establishing implementable operational and procedural standards for ship-dismantling operations, attention will be given to the subject of achievement. This includes assessing feasibility (measuring gaps and identifying priority improvements), building awareness and establishing improvement incentives, including requirements for monitoring, verification and reporting.

3. PRINCIPLES OF ENVIRONMENTALLY SOUND MANAGEMENT OF SHIP-DISMANTLING

3.1 Concept of the Basel Convention

Background

An obligation of the Basel Convention is that hazardous wastes should be reduced to a minimum and dealt with where it has been produced, to the extent possible. Transboundary movements of hazardous wastes or other wastes can take place only upon prior written notification by the state of export to the competent authorities of the states of import and transit. Each movement must be accompanied by a *movement document* and consent by the latter. Hazardous waste shipments made without such documents are illegal.

Another primary objective of the Convention is to protect human health and minimise hazardous waste production whenever possible, through Environmentally Sound Management (ESM). This means the issue should be addressed through an integrated life-cycle approach, which involves strong controls from the generation of a hazardous waste to its storage; transport; treatment; reuse; recycling; recovery and final disposal.

Applicability for the ship-recycling industry

Various materials historically used in the construction and operation of ships will become hazardous wastes under the Convention. These materials include, amongst others, asbestos, PCB's and substrates derived from the normal operation of ships, such as oil residues and products containing heavy metals.

These materials are released during the extraction phase of the dismantling process. The need for an Environmentally Sound Management of the ship-recycling industry is therefore apparent.

3.2 Environmentally Sound Management (ESM) - definition

Article 2.8 of the Basel Convention defines ESM as follows:

> "Environmentally sound management of hazardous wastes and other wastes" means taking all practicable steps to ensure that hazardous wastes or other wastes are managed in a manner which will protect human health and the environment against the adverse effects which may result from such wastes.

Further, the Article 4.2 of the Basel Convention has a direct relevance to the drafting of Guidelines for Environmentally Sound Management:

Article 4.2

Each party shall take the appropriate measures to:

(a) *Ensure that the generation of hazardous wastes and other wastes within it is reduced to a minimum, taking into account social, technological and economic aspects;*

(b) *Ensure the availability of adequate disposal facilities, for the environmentally sound management of hazardous wastes and other wastes, that shall be located, to the extent possible, within it, whatever the place of their disposal;*

(c) *Ensure that persons involved in the management of hazardous wastes or other wastes within it take such steps as are necessary to prevent pollution due to hazardous wastes and other wastes arising from such management and, if such pollution occurs, to minimize the consequences thereof for human health and the environment;*

(d) *Ensure that the transboundary movement of hazardous wastes and other wastes is reduced to the minimum consistent with the environmentally sound and efficient management of such wastes, and is conducted in a manner which will protect human health and the environment against the adverse effects which may result from such movement;*

(e) *Not allow the export of hazardous wastes or other wastes to a State or group of States belonging to an economic and/or political integration organization that are Parties, particularly developing countries, which have prohibited by their legislation all imports, or if it has reason to believe that the wastes in question will not be managed in an environmentally sound manner, according to criteria to be decided on by the Parties at their first meeting;*

(f) *Require that information about a proposed transboundary movement of hazardous wastes and other wastes be provided to the States concerned, according to Annex V A, to state clearly the effects of the proposed movement on human health and the environment;*

(g) *Prevent the import of hazardous wastes and other wastes if it has reason to believe that the wastes in question will not be managed in an environmentally sound manner;*

(h) *Co-operate in activities with other Parties and interested organizations, directly and through the Secretariat, including the dissemination of information on the transboundary movement of hazardous wastes and other wastes, in order to improve the environmentally sound management of such wastes and to achieve the prevention of illegal traffic.*

It becomes evident that in order to achieve ESM-compliant procedures, it may be necessary to address factors of the process other than those directly related to the actual dismantling facility. Meeting ESM-objectives may include aspects related to the object (the ship) undergoing dismantling as well as the crew undertaking the work.

ESM includes measures regarding the prevention of wastes. An efficient approach to this would be to consider the implementation of "clean" ship design practices. This is only applicable to new vessels. Clean ship design practices would encompass the optimisation of a vessel's performance in all it's life cycles with respect to health, safety and the environment, including considerations of material compositions. Environmental aspects should be considered and viewed in light of compliance to the principles of sustainable conduct. Subjects encompassing consumption of unrecoverable raw materials and the associated energy-demanding processing, as well as minimising waste and optimising recycling at disposal should be addressed. From an environmental perspective, the management of hazardous wastes should follow the following hierarchy (in descending order of desirability):

- Waste prevention – do not produce it!
- Waste minimisation – if hazardous waste cannot be prevented, only minimum quantities should be used
- Recycling

- Re-processing – waste that cannot be recycled should be treated in a way that makes it nonhazardous
- Disposal – if waste cannot be rendered nonhazardous, it can be disposed of in a safe manner including monitoring for leaching and other adverse effects

Hence, the challenge for the decommissioning phase is to minimise the amount of hazardous waste generated and to maximise recycling/ reuse of materials/ components. Accordingly, the choice of the materials in the design phase must take this challenge into consideration. For existing vessels, attempts should be made to phase out hazardous materials during the operational phase. These aspects interfere with ship technical issues and are included in the perceived role of the IMO (see section 2.3). These guidelines are limited to the actual dismantling process and do not include such aspects.

3.3 Specific challenges for ship-dismantling in relation to ESM

Decommissioning for disposal (illustrated in Table 1) is essential for world fleet renewal. A vessel largely consists (for some type in the region of 90%) of steel and consequently, the process offers the opportunity of recycling on a considerable scale. In addition to being a source of supply of scrap steel for recycling, equipment, components and onboard consumables may find new applications.

Ship dismantling generates a stream of waste consisting of a mixture of materials including:

- Ferrous and non-ferrous scrap including coatings
- Components: machinery, electrical/ electronic equipment, joinery, minerals, plastics
- Consumables: oils, chemicals, gas
- Hazardous Wastes: asbestos, coatings, PCBs, materials such as electronic waste, which may be hazardous depending on its components and the manner in which it is disposed

The dismantling process generates debris reflecting the composition of the waste stream and further emissions/ discharges caused by applied procedures.

Main challenges to ESM are related to the management of the waste stream including:

- Extraction
- Sorting, segregation and preparation (cutting, etc.)
- Transport, storage and disposal

Following the processes of extraction, sorting, segregation, and preparation, reusable components and recyclable substances/ materials are recovered.

Dismantling challenges – the waste stream

Both operational and environmental challenges will mirror the characteristics of the vessels requiring dismantling. Similarly, required future dismantling capacity is governed by the specifics of the ageing world fleet.
The supply of dismantling candidates arriving from the world fleet of merchant vessels, has been estimated at a suggested annual 500-700 cargo carrying vessels representing some 25 mill. dwt. at an average age of 25-26 years. These figures are based on regulations, on available statistical and ship registration data and represent a predicted trend for the next 15 years. The figures suggest an

increase in ship-dismantling capacity at some 10-15 %, when compared to the average annual disposal figures from 1994-1999.

Table 2 links critical aspects of the dismantling process to actual challenges. Table 3 elaborates on these and identifies releases from the process and potential environmental consequences.

Table 2 Critical aspects and environmental challenges

Critical aspects	Challenges
Type and size of ship	Dismantling capacity needs to accommodate for vessels of different characteristics and should be designed to suit a range of size and type. Cruise ships and naval vessels prove exceptions to the remainder tonnage due to differing steel content/ quality and the wide variety of output materials. The throughput rate of ships dismantled is a function of both range capability and on-site topography and ground conditions.
Access	Easy controllable overall access is of key importance. This can be facilitated by requiring the dismantling candidate to meet certain norms. Inventory: prepared ship inventory – physical marking of hazardous materials. Precautions: removal, cleaning, system shut-down, securing (explosive/ non-breathable atmospheres). Access is significantly influenced by facility specifics: docking (dry-docks), mooring at pier, beaching.
Containment	Both the extraction process itself as well as the subsequent process of sorting/ material preparations, storage, disposal and transport can inevitably cause potential releases to the environment (air/ sea/ ground): debris, liquid residues, fumes following cutting/ burning. Maintaining containment is largely dependent upon facility specifics: docking (dry-docks), mooring at pier, beaching.
Recycling, removal, disposal	The dismantling process generates components and materials feasible for reuse or recycling which are transported out of the facility. Some of these "products" may be contaminated (coated steel plating), hazardous, or in other ways undesirable in terms of return to market. Some materials such as PCBs (and other persistent organic pollutants (POPs)) and asbestos, must under no circumstances be recycled. Adequate, safe, monitored storage and disposal facilities must be available for hazardous wastes. The facility should develop a policy on the products it intends to provide. Input for such may be found in chapter 4.2.

Training	Awareness and skills are essential from both an environmental aspect, as well as from that of occupational health and safety. Training of workers should be given appropriate emphasis including operational/ technical/ environmental procedures and use of personal protective equipment. Only sufficiently trained personnel may have access to the various areas in the ship dismantling yard.

Environmental concerns - potential releases to air, water and ground

Correct handling of substances released from dismantling is of utmost importance in order to avoid contamination of air, drinking water and the food chain. Contamination can have both acute and long term effects and may not only be limited to the workforce but may also result in serious health and welfare implications influencing larger communities.

Major environmental concerns relate to:

1. *Location:* The nature of the dismantling facility may not be compliant with the vulnerability of the location or the requirements of the population.

2. *Operation:* The specifics of the facility may represent insufficiencies with respect to containment and preventing toxins from entering water, sediments/ ground and/ or air.

These concerns should be thoroughly addressed by the EIA (see chapter 6.2). Governments should make provisions to ensure that such assessments are carried out and that recommendations gained from these are adhered to.

Hazardous substances and other substances of general concern to the environment, which are typically present in the dismantling candidate, are listed in Table 3. The table also provides information on source, environmental exposure and links to the List A in the Basel Convention, which contains wastes that are characterised as hazardous under Article 1, paragraph 1 (a) of the Convention. A list of hazardous wastes and substances from List A in the Basel Convention that are on board or inherent in the ship's structure when the vessel arrives at a dismantling site is provided in Appendix B. Environmental impacts and some related safety and health aspects caused by both the substances as well as the handling methods applied (*waste handling*), are further detailed in chapter 4.2.

Table 3 Typical releases from ship-dismantling industries

Potentially hazardous material	Hazardous components	Source identification	Process-generated waste	Environmental Exposure	Environmental effects	Links to List of Wastes (see appendix B)
Metals	• Metals may contain or be coated with toxic materials • Heavy metals (e.g. lead, mercury)	Anodes and batteries, paints, motor components, generators, piping, cables, thermometers, electrical switches, light fittings, etc.	Metal fumes (e.g. cadmium-coated steel, iron oxides, zinc oxides, chromium in some paints), particulates and material chippings are produced during cutting operations	Exposure to hazardous metal fumes is primarily an occupational health problem, but metal fumes can also be dispersed by air and may be deposited far away from their source. Potentially hazardous metals may spread to the ground and to the water when metal-containing products are stored improperly or are not properly disposed of.		A1010 A1020 A1030 A1080 A1160 A1180 A2010
Oils and fuel	• Hydrocarbons • Sludge • Heavy metals • Explosive vapours	Piping and tanks, drums, machinery spaces, machine-shops, tanker cargo holds	Oily wastes from cleaning operations	Dispersed to the external environment through air, water and ground.	Fire and toxic hazards to workers. Both petroleum products and non-petroleum oils can have adverse and well-documented effects on the environment.	A3020 A4060
Bilge and ballast water	• Oil and grease • Residual fuel • petroleum hydrocarbons • Biocides • Heavy metals and other metals • Non-indigenous organisms	Bilge water is drainage water located in the ship's hull (machinery area). Ballast water is found in ballast tanks and/or cargo tanks.	Oily wastes from cleaning operations. Discharge of toxic organics may cause release of poisonous gases.	Bilge and ballast water is released to the environment directly or by lack of containment during transfer operations. The aforementioned hazardous components may be dispersed to the external environment through air, water and ground.	The introduction of non-indigenous species disturbs the ecological balance. The threat to local and regional biodiversity may have great economic consequences. Ballast water may also carry pathogenic organisms which threaten human health. Oil, petroleum hydrocarbons, biocides and certain metals may have toxic effects on the external environment. Oil also causes physical damage to the external environment.	A4130
Paints and coatings	• PCBs • Heavy metals (e.g. lead, barium, cadmium, chromium, zinc)	Anti-corrosion paint and antifouling coating. Fresh paint for maintenance purposes may be found onboard.	Removal of toxic paints and coating from areas to be cut will generate waste. The type of waste will depend on the method of removal (chemical stripping, abrasive blasting or mechanical removal).	Exposure to hazardous paint fumes during metal cutting is primarily an occupational health problem, but paint fumes will also disperse through the air and may be deposited far away from their source.	Flammable paint represents a fire hazard to workers. Thermal removal must not be used on PCB-containing paint because dioxin emissions may be generated. Waste from the paint removal processes can have negative impacts on both health and the environment.	A1040 A4030 A4070

Table 3 Typical releases from ship-dismantling industries

Potentially hazardous material	Hazardous components	Source identification	Process-generated waste	Environmental Exposure	Environmental effects	Links to List of Wastes (see appendix B)
	• Pesticides (e.g. tributyl tin (TBT)) • Organo-mercury compounds, copper oxides, arsenic, solvents					
Asbestos	• Asbestos fibres	Thermal system insulation and surfacing material		When ACM is deteriorated, asbestos breaks up into very fine fibres which disperse through the air. Primarily an occupational hazard, but fibres may also spread to the surrounding environment.	Inhaling high levels of asbestos fibres can lead to an increased risk of lung cancer, mesothelioma and asbestosis.	A2050
PCBs	• PCBs	Cable insulation, thermal insulation material, transformers, capacitors, oils, paints, plastics and rubber, etc.	Even more toxic that PCBs themselves are the chemicals produced when PCBs are heated (polychlorinated dibenzofurans and polychlorinated dibenzo-p-dioxins).	PCBs can affect workers through dermal contact or inhalation. PCBs can spread to the surrounding environment through the ground and/or water if not handled and disposed of in an appropriate manner. Cable burning for the recovery of copper wire can generate very toxic dioxins and should therefore not occur.	PCBs are toxic and persistent in the environment and have been shown to cause a number of adverse health effects.	A1180 A3180
Cargo residues	• Chemicals • Oils • Gases	Cargo tanks / holds	Chemical/ oily wastes from cleaning operations	Dispersed to the external environment through air, water and ground.	Dependent upon cargo. Chemicals, petroleum/ non-petroleum oils can have adverse effects on the environment. Fire and explosion hazards may apply.	A4130 A4080 A3020
Other	• Chemicals • Flame retardants	Antifreeze fluids, compressed gases, CFCs		This depends upon type of release	This depends upon type of release	A3140 A4080

3.4.1 Existing practices and standards

Current practices - overview

Current shipbreaking is centred in Pakistan, India, Bangladesh and China. These countries constitute about 89% of the tonnage (dwt) (see Figure 3 below). OECD countries contribute a large percentage of the tonnage broken up at the ship-dismantling facilities in Pakistan, India and Bangladesh. In numbers, a total of 49% of OECD vessels were scrapped outside the OECD (Data source: Lloyd's Register, 2000). This represents approximately 93% in tonnage (dwt). It should be noted that many ships are managed and operate in OECD member countries, but are under other countries' flag.

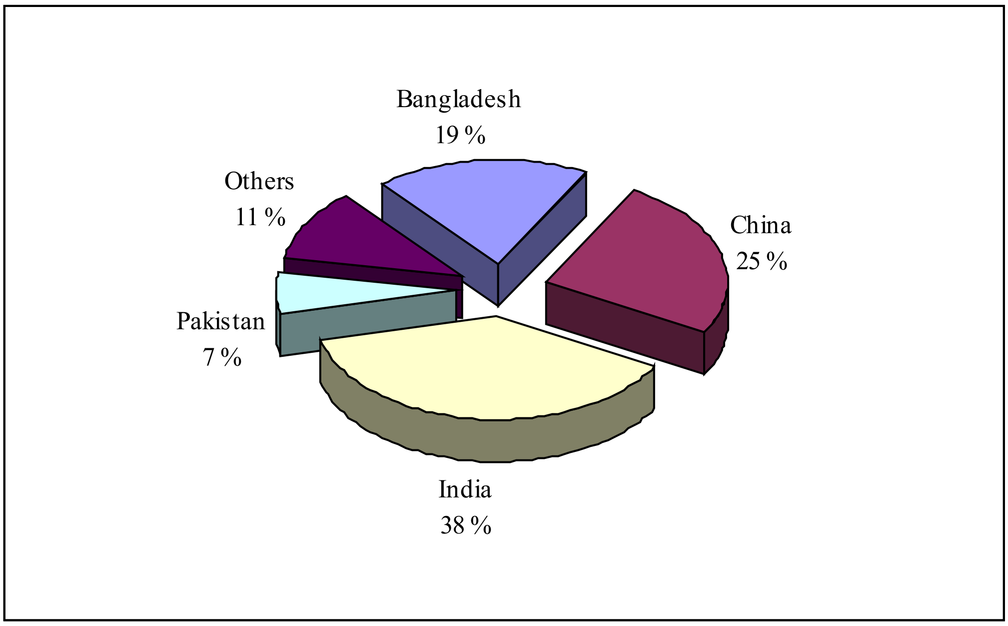


Figure 3 Breaker countries in 2000 distributed by DWT (Data source: IMO doc I:\MEPC\46\7.doc, based on data from Clarkson Research Studies)

The need for employment and a lack of available investment capital is a common key factor shared by the world's major ship-dismantling nations. The current ship-breaking sites lack mechanised facilities allowing access to the hull, lifting capacity is non-existent and all demolition procedures are undertaken outdoors. There may be some variations in procedures from location to location, but in general terms principles are virtually identical with very few exceptions.

Vessels destined for retirement for whatever reason, are put up for sale on the scrapping market and sold to the highest bidder for delivery usually on site in an "*as is*" condition.

Due to the availability of manpower and the presence of a market for second hand equipment and components, the dismantling procedure can be based around the principle of maximum separation, and mirrors a reverse "*ship building*" process, being similar in that it is labour intensive, but does not make use of technology commonly adopted in modern ship building. This is perhaps best illustrated by the established principle of beaching the scrapping candidate (common practice within all scrapping nations with few exceptions).

Compared to standards or general norms expected within the industrialised countries, the current method of ship-breaking fails to comply in many aspects. The extent and nature of non-compliance has been demonstrated by on-site case studies and available literature. It becomes instantly evident that gaps to be bridged to achieve compliance to norms and expectations of the industrialised countries are potentially large, and would require capital investment in facilities, process control and radically different working practices and conditions. Furthermore, a local legal and cultural framework would need to be in place to ensure that any new measures and actions introduced would be adhered to.

Compared to local standards, the situation may not appear to be so detrimental. Priorities are different and few alternative lifestyle opportunities are afforded. There is no doubt that the impact of these industries on the local community and economy is considerable, and this should be taken into account when considering the introduction of any new measures or actions. It would be difficult to ignore the social implications if large volumes of ship-breaking from these existing operations were to be removed as they generate employment and revenue for the local economy. On the other hand, this may be the very consequence if constructive improvements on both environmental issues and on health and safety are not achieved.

As a result of abundant low-cost labour, the existing dismantling sites have the advantage of low operating costs. In addition, these less well-developed countries also provide a ready-made market for many of the components that arise from the ship-dismantling process, such as pumps and generators. These components do not necessarily comply with regulations or perform to expectations that would permit their reuse elsewhere.

In summary, the existing locations offer four critical factors:

- An abundance of low-cost labour willing to carry out the work
- Insufficient or non-enforced legislative frames
- A ready-made market for dated components/ items such as pumps, generators, compressors, motors and so on
- Conveniently large inter-tidal zone areas where high tide allows the vessel to be beached under own power

Decommissioning and sale for scrapping

When a ship has become obsolete in the market it serves or is deemed non-compliant for other reasons and hence reaches the end of its useful life, it is usually offered for sale to a ship breaker either through brokers or to "cash buyers" (companies that buy the ships and resell them to the ship breakers).

<u>Alternative 1:</u> The shipowner may sell the ship directly to a ship breaker company, or more often through a broker. When the ship is sold to the ship breaker company, the shipowner must provide for transportation of the ship to its final destination. The ship is sold for the obtainable market price at the time of sale.

<u>Alternative 2:</u> The shipowner sells the ship to a "cash buyer" company, which again will transport the ship to the ship breaking location. The price obtained for the ship is then lower than in alternative 1.

The driving factor determining the price the market is willing to pay for the ship is a function of the amount of steel onboard. Consequently, ship type and lightship weight are essential parameters. However, the trading of second hand equipment or components is essential in the profit-making process. It should be noted that the ship breaking nations have introduced taxation on tonnage imported for scrapping. The level of this varies and will affect the prices offered.

The ship arrives at the scrapping site and is beached under own power. This implies that the vessel must be "shipshape" and in compliance with valid certificates until actually positioned on the beach. Consequently, the possibilities available for preparing the vessel for scrapping with respect to removal of harmful onboard substances prior to arrival ("*decontamination*") may be limited. The principle of beaching requires the vessel to be under own power and hence will not allow preparations affecting the required certificates (towing is not an option).

There are no international requirements or standards relating to the condition or to the documentation which should follow the vessel when destined for the breakers. Consequently, a ship owner will most often not have undertaken any onboard precautions nor will he be able to provide specifications for onboard hazardous materials. There may however be some national requirements in the country where the ship is to be dismantled. Such national requirements have however when enforced, led to tonnage being moved to other countries where such "obstacles" are absent.

Since the scrapping candidate is still subjected to the laws of the seas including the provisions of both SOLAS and MARPOL, there may also be valid requirements that have relevance for the scrapping process. Annexes I, II, IV, V and VI to the MARPOL Convention require the establishment of appropriate waste-reception facilities for the reception of ship-generated waste (in accordance with the substances of the respective annexes). Table 4 provides an overview of the status of the convention for the relevant ship-dismantling nations.

Table 4 Status of the MARPOL Convention for the major ship-breaking nations

	Country	Bangladesh	China	India	Pakistan
MARPOL 73/78	Annex I/II	Not ratified	Ratified	Ratified	Ratified
	Annex III	Not ratified	Ratified	Ratified	Ratified
	Annex IV	Not ratified	Not ratified	Not ratified	Ratified
	Annex V	Not ratified	Ratified	Not ratified	Ratified
	Prot. 97 (Annex VI)	Not ratified	Not ratified	Not ratified	Not ratified

Notes: MARPOL (MARPOL 73/78) – International Convention for the prevention of Pollution from Ships, 1973, as modified by the Protocols of 1978 and 1997 relating thereto. Annex I – Regulations for the Prevention of Pollution by Oil. Annex II – Regulations for the Control of Pollution by Noxious Liquid Substances in Bulk. Annex III – Regulations for the Prevention of Pollution by Harmful Substances Carried by Sea in Packaged Form. Annex IV – Regulations for the Prevention of Pollution by Sewage from Ships. Annex V – Regulations for the Prevention of Pollution by Garbage from Ships. Annex VI – Regulations for the Prevention of Air Pollution from Ships.

Contractual documents are sometimes prepared by the breakers, but more often by the broker or the "cash buyers". "SALESCRAP 87" (provided to the shipping industry by BIMCO) has been the only standard contractual format commonly used for supporting sales for scrapping. This document has been revised, and the updated version is expected to be available from March 2002.

Demolition - principles of the dismantling process

In principle, the process of ship dismantling consists of a sequential chain of operations undertaken at different locations:

- Offshore: Prior to beaching, tanks are discharged and valuables (uncontaminated oil-products, consumables and saleable items such as electronic equipment) are removed. Ship-generated waste may be subjected to the provisions of national regulations if respective nations (flag states and/or port states) have ratified obligating annexes to MARPOL.
- Inter-tidal zone: The vessel is beached under its own power and demolition is initiated (in a certain sequence).
- The beach: Further cutting into manageable sizes, extraction of components and sorting for transport to respective receivers is carried out.
- In-land: Supply of second hand equipment and components to (local/ regional) market and re-manufacturing/recycling into new products/components. (Disposal and recycling).

These operations are detailed somewhat further in Table 5.

Table 5 The ship-breaking operation

Location	Operations	Comments
Offshore	Onboard consumables, saleable (loose) equipment is removed. Tanks emptied (in some cases, cargo tanks are washed). The vessel is made as light as possible in order to enable it to "climb" as high as possible up on to the beach (e.g. discharge is done at site).	These operations are carried out at or near the breaking facility. If reception facilities are not available, tank residues/ ballast water, etc. are discharged to sea.
Inter-tidal zone	The vessel is beached under its own power to gain access for structural demolition. The ship bow/ stern and sides are opened to gain further access to components of value. Hull plating, larger sections and structural items are opened/ removed and sequentially extracted and winched/ towed or floated ashore.	**Antifouling, hydrocarbons in pipeworks, void spaces, remains in tanks etc., and debris (heavy metals, paint remains, dust (asbestos, etc.)) are deposited in the water/ ground sediments/ air. Emissions to air due to cutting.** *Torch cutting, material-handling and associated work-operations induces potentially dangerous situations; burns, falls from heights, overloading by carrying, crushing, being hit by falling objects, suffocation, explosions, exposure to toxins and/ or harmful materials, and so on.*
The beach	Size reduction of recovered scrap steel by torch cutting. Sorting of recovered materials (scrap steel, components, etc.). Transport/ export of materials and substances.	**Leaks from collected liquid-storage to soil due to insufficient or lacking containment. Debris (heavy metals, paint remains, dust (asbestos, etc.)), residues from systems/ tanks, etc deposited into sediments. Emissions to air due to cutting and fires (removal of insulation, and so on).** *Ongoing cutting/ sorting/ transport operations causing potentially dangerous situations; burns, falls from heights, overloading by carrying, crushing, being hit by falling objects, suffocation, explosions, exposure to toxins and/ or harmful material, etc.*
In-land	Sorted materials are transported to nearby markets or reprocessing facilities. (Disposal and recycling).	**Hazardous materials exported from the breaking site (e.g. paint remains on scrap steel platings for cold-rolling/ smelting, re-use of hazardous materials (Asbestos Containing Materials (ACM)).** *Transport, overloading by carrying. Operations within the re-processing sites can cause incidents reflecting the nature of the reprocessing activity (for example burns caused by re-melting).*

* **Bold** - environmental aspects; Italics - safety aspects

Disposal and recycling

The waste material stream following demolition is distributed and transported out of the dismantling site to local enterprises for re-sale, re-manufacturing or recycling. These enterprises are usually located within the vicinity of the dismantling facility and are often under the same or related ownership.

Re-sale:

The trade of recovered usable items may be found in the vicinity of the scrapping facilities or items may be transported to central areas (main cities) for re-sale. The individual trade facilities tend to specialise according to item type. The following is a listing of item-groups typically offered for direct re-sale (no re-processing/ re-manufacturing):

- pumps, valves, motors, machines
- navigational equipment
- life-saving equipment (rafts, lifebuoys, life-vests, survival suits, etc)
- personal protective equipment (helmets, workboots, gloves, goggles, overalls, etc.)
- Chemicals and paints
- Steel components (anchors, chains, ventilation components, pipework, etc).
- Sanitary equipment (toilets, sinks, bath tubs, and so on).
- Furniture
- Electrical cabling (intact) and batteries
- Insulation material
- Oil products (to manufacturing industries)

Re-manufacturing/ re-processing:

A comprehensive proportion of the waste stream is re-processed or re-manufactured rather than recycled prior to sale. The following illustrate this:

- *Steel re-manufacturing:* Not all extracted steelwork is characterised as scrap. “Undamaged” plating is re-manufactured by cutting, grinding and hot-work. Anchors, chains, engine structures, and so on may also be re-manufactured by undergoing similar treatments.
- *Oil re-manufacturing: Used (dirty) oils (lubricating oils) are re-processed and offered for sale.*
- *Mineral re-processing: Insulation material (asbestos) is in some facilities reprocessed by manual crushing and sold to manufacturing industries.*
- *Copper reclaim: damaged cabling or non-saleable cabling is stripped for insulation either by burning or by mechanical stripping (sometimes also carried out at the scrapping site).*

Recycling:

Real recycling in the sense of waste being used as a raw material in the production chain is first and foremost represented by scrap steel. This is the raw material for steel works and for cold-rolling facilities. The quality of the end product is a function of the quality of the available scrap, the sorting and the recycling process.

Current practices and standards – main ship-breaking nations

Most nations involved in ship breaking make references to some form of national regulations, guidelines and/ or recommendations covering the ship-dismantling industries, including the issues of site-licensing as well as occupational safety, health and environmental concerns. However, there is evidence suggesting that these have not been fully implemented in some of the major ship-breaking countries.

3.4.2 India

India is the world's leading ship-breaking nation in items of volume. Activities are centred along the beaches of Alang in the Indian State of Gujarat.

Insufficiencies relating to workers' health and safety and protection of the environment have been affirmed by several independent assessments at both Alang and other ship-breaking sites.

From the investigations undertaken, high concentrations of heavy metals, asbestos, PAH, and tributyl tin (TBT) were revealed. A lack of waste reception and disposal capability have been revealed and particular focus has been drawn to the careless handling of hazardous substances such as ACM. Workers at the dismantling sites in Alang are exposed to these contaminants 24 hours a day, living as they do within the immediate vicinity of their workplace.

Legislative frames

The Central Pollution Control Board in Delhi has prepared "Environmental Guidelines for Ship-breaking Industries" aiming to "minimise the effect of ship-breaking industries on the surrounding environment through proper siting of industries and by preparing and implementing an Environmental Management Plan (EMP) and a Disaster Management Plan (DMP)". The guidelines include a description of the appropriate pollution-control measures regarding solid waste, air pollution, water pollution and noise. It also includes workers' safety aspects. Regular monitoring on the implementation of the EMP is the responsibility of the concerned State Pollution Control Board (SPCB). The Environmental Management Division is responsible for the monitoring of for example water pollution and air pollution on a regular basis.

Gujarat Maritime Board (GMB), the administrator of the areas in which scrapping activities in Alang are undertaken, introduced new regulations on 31 August 2000 covering safety measures for the beaching of the vessel. The following provides a brief summary of the regulations:

Beaching:

- Documentation - gas-free certification
- Permission to beach a vessel
- Limitations on number of ships and the location of these (distance between vessels) per plot

Precautions prior to the start-up of cutting operations:

- Permission to be issued by GMB following the removal of hazardous substances
- The provision of fire-fighting capacity
- Supervision by GMB safety officers in co-operation with the owner of the plot

- Identification of all workers engaged (by the issue of ID-cards and the introduction of monitoring by card-reader at plot entrance)

Incident-reporting procedures:

- Introduction of penalties/ temporary cancellation of required operation permissions in the event of incidents/ accidents

National initiatives

The Gujarat Maritime Board (GMB) has recently responded to the considerable media attention that India has received due to the potential environmental and health problems at their ship dismantling facilities. GMB is actively dealing with the issue, for instance with the framework of the Port Development Gujarat Programme (PODEG). PODEG is a Gujarat-Netherlands cooperation programme that mainly consists of the transfer of expertise. One of PODEG's activities i.e. ship recycling, aims at improving both environmental and safety conditions, improving living and social condition and improving institutional development in relation to restructuring.

PODEG sponsored a workshop on the ship recycling industry, which was held on 19 February 2000 in Bhavnagar, India. The following are examples of initiatives, actions and findings reported by GMB following the workshop:

- Research on incidents and accidents on Alang; number and causes of casualties and wounded (completed Sept. 2000)
- Training programme for foremen and for workers (Sept. 2000- Sept. 2001)
- Information campaign for raising awareness of safety matters for workers (end of 2000)
- Prepare a waste-management plan for Alang (Sept 2000 - June 2001)
- New regulation for beaching (emitted August 2000)
- Enforcement of existing (and new) rules
- Plans for housing 30,000 workers (pending)
- Plan for establishing a Labour Safety Institute (pending)

Part of the PODEG budget has been allocated for actions and investments in Alang. The execution of the plans of the GMB has been delayed because of the earthquake that hit Gujarat in February 2001.

A High Powered Committee on Management of Hazardous Waste (HPC) was constituted by the Supreme Court of India on 13.10.1997. The scope of the work for the HPC was to produce "*a comprehensive and long-term perspective document relating not just to the regulation of imports of hazardous wastes under the Basel Convention, but also the management and safe disposal of all hazardous wastes including those generated within the country and to minimise hazards arising from them"*. A report from the HPC on the management of hazardous wastes was issued before May 2001 with a new indication that there is an enormous need for improvement of the existing hazardous waste situation in India. The HPC also provides recommendations on certain steps to be taken to ensure that ships coming to India for ship breaking are properly decontaminated prior to arrival at port. Examples of such steps are:

- that the ship has proper consent from the concerned authority or the State Maritime Board stating that it does not contain any hazardous waste or radioactive substances

- that the waste generated from the ship breaking process is classified into hazardous and non-hazardous categories
- that hazardous substances are handled and disposed of in a certain manner

3.4.3 China

China offers the essentials of both low labour costs and market opportunities. A high demand for construction steel and a well developed infrastructure are important factors that over the last few years have enabled China to return as a major contributor to ship-breaking after some years of relative absence. More important however, are recent changes in the taxation of vessels imported for scrapping, making Chinese breakers more competitive.

Breaking operations in China differ from the other three major scrapping nations in that the use of dock-like facilities and/ or quay-based facilities have been introduced. The improved potential of safeguarding the environment represented by the introduction of technology (cranes, docks, etc.) has been promoted widely and has attracted some shipowners looking for dismantling capacity. "China National Shipscrapping Association" representing approximately fifteen major breaking yards, has recently undertaken promotion tours in Europe under the banner of "Clean Recycling of Ships in China".

The following lists current principles of ship breaking and recycling in China adopted and presented by representatives of the "China National Shipscrapping Association":

Aspects/ requirements at the yard:

Vessels are to be broken up alongside quay and ashore.
The yard should have waste reception and storage facilities and separate storage facilities for hazardous materials according to environmental and safety regulations.
The yard should have separators to deal with sludge/oil remnants.
The yard should have an emergeny plan or procedures in order to deal with oil spills, personal accidents, fire, and accidents with hazardous materials.
The yard should have facilities to provide first aid to injured persons.
The yard should be equipped with fire-fighting equipment.
The yard should be guarded against unauthorized entrance.
The yard should work with safety regulations and procedures.
The yard should work with prevention procedures.
The yard should work with procedures to protect the environment and establish an environmental policy.
The yard should have a health programme for their workers.
The yard should have a safety maintenance programme for their equipment.
The yard should have clear working procedures to which all employees should adhere

Certificates/Licenses:

The yard should be a member of a general/master organization for demolition yards, which issue rules of conduct.
The yard should be licensed to break-up vessels and report to the authority that issued the license.
The yard should work with the approval of the environmental authorities and present a license that has been issued in this respect.
Environmental authorities should regularly inspect the yard.
The yard should present an import license if required to buy vessels.
When using sub-contractors, either for breaking up and/or transport/collecting waste products and/or transport/handling of hazardous materials, it should regularly be checked that they themselves are properly licensed.
Existing rules and regulations regarding the handling and disposal of hazardous products are to be followed up by the yard.

Staff/Employees:

The staff should be trained to handle and store hazardous materials and to provide first aid to injured persons.
The staff should be trained for fire-fighting and to handle oil spills.
The work force on the yard should wear safety helmets, safety shoes, eye protective glasses and working gloves.
The workforce on the yard should wear facemasks when dealing with toxic materials or materials which generate toxic fumes.
The workforce, handling asbestos or materials containing asbestos, should wear protective clothing and masks.
The workforce cutting steel by torch should be protected against inhaling possible toxic fumes originating from paints.

Working procedure:

Assessment of which hazardous products the vessel contains before a vessel is accepted for demolition and recycling.
Employees should be appointed to make sure that internal and external rules and regulations are adhered to by all involved.
Cutting of steel preferably to be done by hydraulic scissors or water jet.
The keel should be broken up ashore.
All residual oils from the vessel should be taken ashore , oil-trapping gates should be prepared.
The last remnants of fuel/diesel oil and sludge should be removed by pumping fuel/diesel remnants to bilge pools on shore and use separators to handle the remnants before scrapping the vessel.
Asbestos from the vessel's structure should be removed by workers wearing protective clothes and masks.
Measures should be taken to prevent asbestos dust/fibres from entering the air while removing loose asbestos.
Electric cable insulation which is hazardous should be removed in the same way as removing asbestos. Burning of this insulation is prohibited.
Asphalt/bitumen sticking to steel should be be scratched off.
Insulation sticking to steel should be removed and waste separated by workers wearing protective clothes and masks.

Possible hazardous (waste) products:

Batteries should be sent to licensed dealers who have special skills in handling them.
Diesel oil should be pumped and gathered on shore and sent to licensed dealers for handling.
Electrical components should be cut off and tested for electricity before dismantling.
Fibre/glasswool slabs should be sprayed with water to reduce dispersion.
Fire detectors should be handled by workers wearing protective clothes and masks.
Freon/ Halon (in bottles and in vessel's cooling systems) should be handled by licensed dealers.
Fuel oil (remnants) should be pumped and gathered on shore and passed through separators before being disposed of.
Granulated cork should be handled by licensed dealers.
Lubricating oil should be pumped and gathered on shore and passed through separators before being disposed of.
Paint remnants should be collected by licensed dealers.
Plastics/PVC should be removed to shore from the vessel and then sorted for collection by licensed dealers.
Polyurethane foam (sprayed) should be handled by licensed dealers.
Polyurethane sheets should be removed to shore from the vessel and then sorted for collection by licensed dealers.
Rubber shall be removed to shore from vessel and sorted and then collected by licensed dealers.
Transformer oil should be removed to shore from the vessel and then sorted for collection by licensed dealers.
Wall panels/bulkheads (could contain some asbestos as heat-resisting material), asbestos should be removed first and panels/bulkheads should be removed to shore and then sorted for collection by licensed dealers.

Inspections:

The yard should accept regular inspection/supervision by the Seller or their nominated representatives during demolition of the vessel.
The yard should accept visits from third parties including press or persons representing environmental groups.
The yard should provide the Seller with a complete set of documentation, including pictures, after the demolition is completed. The documentation should also verify deliveries to licensed dealers mentioned above.

In recent years, about 1.5 million tonnes of ship scrap-ship have been dismantled in China annually, 90 per cent of which has been dismantled on wharf. The China National Ship-scrapping Association, at its latest council held in December 2001, set a target of establishing green ship-scrapping enterprises. It will help and request the main ship-breaking enterprises in China to conduct ISO 14000 and HSA 18000 consulting assessments.

3.4.4 Bangladesh

The scrapping of ships is currently taking place at several sites along the coast of Bangladesh. The area of Fauzdarhat, a 16-km beach south-west of Chittagong, is the most significant and in fact the second largest ship-breaking site in the world with respect to the numbers of vessels being scrapped.

Chittagong is the world's largest site for large vessels, scrapping some 52% of all vessels above 200,000 dwt (1997-1998). The reason for this is Chittagong's large tidal difference, which provides an inter-tidal zone particularly suitable for beaching of large vessels, but perhaps even more important is the lack of requirements here related to precautions for "hot work" operations.

An on-site assessment of this area revealed i.a. high concentrations of oil in water and sediments, high levels of heavy metals, PCB and tributyl tin (TBT) in soil samples. Asbestos was omnipresent. These findings support the claim of environmental contamination caused by ship-breaking activities.

Other studies have identified issues in direct contrast with the fundamental principles of environmental sound management and occupational health and safety:

- Drinking water for the workers is extracted from tube-wells that are sunk in each ship-breaking yard.
- Rest-room facilities for the workers are not provided.
- Gascutters and their helpers cut steel plates continually without eye protection, uniform, protective gloves or boots. Workers carry weights far above the limit prescribed in local regulations.
- Enclosed spaces on the ship are not properly cleaned prior to beaching and may contain dangerous chemicals or fumes. Workers enter, unaware of the hazards, and consequently suffer from suffocation, injuries to the lungs, and so on. Some spaces may also contain explosive gases, and when the gascutters drill holes or by other means try to release these, severe explosions and fires can sometimes occur.

The study did not suggest any safety or environmental measures, nor did it confirm compliance to the regulative requirements outlined below.

The scrapping plots at Fauzdharat are located within the immediate vicinity of fishing villages. The conflict between fisheries and the scrapping industry is obvious.

Legislative framework

A national regulative framework for managing ship scrapping has been established. This includes:

- Approval procedure for the site-operator under the responsibility of The Ministry of Commerce and Industry
- The issue of a "berthing certificate" for each individual vessel to be scrapped (Port authorities under the Ministry of Shipping)
- The issue of a "hot work" certificate (under the Explosive Department)

Furthermore, there is a provision under the Environmental Law (of 1997) requiring that each and every industry including that of ship breaking must have an "Environmental Clearance Certificate" from the Department of the Environment (DoE), Ministry of Forest and Environment. To achieve this, the ship-breaking site must establish an Environmental Management Plan (EMP). The Environmental Law is also intended to cover safety measures, occupational health, waste management, monitoring plans and disaster management. In addition there are some provisions for socio-economic issues.

National initiatives

During the summer of 2000 there were at least two major incidents at Chittagong which caused the loss of several workers' lives. Both incidents were caused by torch-cutting in explosive atmospheres. As a result of these accidents, a demonstration was held in Chittagong against the conditions under which ship-breaking is carried out.

Following the demonstration, the Government has revealed plans to establish a hospital and a fire brigade in the ship-breaking areas. There has also been arranged a two-day training programme for some foremen at the ship-breaking facilities.

3.4.5 Pakistan

According to statistics from 2000, Pakistan was the fourth largest ship-breaking nation. Recent reports suggest however that the activity has rapidly declined and that dismantling of vessels in 2001 was nearly insignificant.

Ship-dismantling in Pakistan is mainly engaged in large tonnage, illustrating that the majority of vessels scrapped are tankers, again suggesting that there are non or few implemented restrictions related to precautions such as "safe for hot work" requirements. The adopted procedure is similar to that of India and Bangladesh in that vessels are scrapped by beaching.

The administration and organization of scrapping in Pakistan is not known in detail. A brief assessment has not succeeded in identifying any references to either environmental issues or to occupational safety and health in the ship-breaking sector. NGOs have reported plans to assess the industry in Pakistan.

3.4.6 Others

Turkey is now the only OECD country that maintains a notable presence in the commercial ship dismantling industry. Their ship-breaking yards are centred around Aliağa on the Aegean coast. The ship-breaking companies in Aliağa have a total capacity of around 500,000 tonnes a year, of which 75% are bulk carriers, 15% are fishery boats and 10% oil tankers (2000 figures).

4. GOOD PRACTICE IN ENVIRONMENTAL CONTROL PROCEDURES AT SHIP-DISMANTLING FACILITIES

4.1 The process of ship decommissioning for disposal

The extraction of the ship structure and its components and parts, resulting in a flow of materials for reuse, recycling and disposal, creates the potential of releases to the environment due to:

- Insufficiencies in preparatory procedures prior to the dismantling process
- Inability to collect/ remove/ secure onboard substances of concern during dismantling
- Insufficiencies in procedures related to the collection, transport and storage/disposal of substances

The nature of the operational procedures and the resulting flow of materials represent potential releases to water, air and ground. In order to safeguard against this, it is necessary to consider all steps in the decommissioning-for-disposal-process in order to allocate corrective actions at the appropriate stages.

Responsibilities connected with the recommendations on specific measures associated with decommissioning and dismantling (see the following) must be identified in the Environmental Management Plan (see also chapter 6).

Dismantling stages

Decommissioning for disposal is a step by step process (illustrated in Table 1):

I. Decommissioning and sale
II. The dismantling process
III. Sorting for reuse, recycling and disposal

In order to comply with the principles of ESM, the dismantling procedure may influence not only the actual dismantling step (I) but may also require actions taken during the progress of the other steps as shown below (the table below is not complete).

Table 6 Steps in the process of ship decommissioning for disposal

Actions	I	II	III
1.	Inventory of onboard hazardous/ polluting wastes	*(Inventory of onboard hazardous/ polluting wastes)*	
2.	*(Removal/ cleaning – liquids, including fuels and oils)*	Removal/ cleaning– liquids, including fuels and oils	
3.	Securing	Securing	
4.	*(Removal of equipment)*	Removal of equipment	
5.		Removal of hazardous/ polluting substances	
6.		Dismantling	
7.		Storage, recycling and disposal	Storage, recycling and disposal

The actions referred to in the table above (Table 6) can be further described as follows:

1. Inventory of onboard hazardous/ polluting wastes

Prior to arrival, or alternatively on arrival at the dismantling facility, an inventory survey of the vessel should be carried out. The survey will identify, quantify and locate the types of wastes on board and will result in an inventory list of hazardous wastes and other wastes. A thorough vessel survey can also be used for the purpose of planning the sequence and nature of the work to be executed, for example, can asbestos-containing structures be marked to facilitate the removal.

Following the inventory of hazardous substances onboard the ship, chemical safety data sheets should be made available for each of the hazardous substances identified in the inventory. The requirements of the UN Globally Harmonized System for the Classification and Labelling of Chemicals as well as the UN Recommendations on Transport of Dangerous Goods should be followed concerning the labelling of hazardous chemicals and their storage. Reference should also be made to the information on the ILO international instruments (Conventions, Recommendations, Codes of Practice) relevant to ship-breaking operations, as well as on important information sources on chemical safety (see also chapter 6).

2. Removal/ cleaning– liquids, including fuels and oils

Prior to cutting, the ship should be cleared of all residual materials. This may be carried out prior to step II or at a cleaning station at the facility. Cleaning of, for example, cargo tanks, bunker and fuel tanks, bilge and ballast compartments, sewage tanks, etc. should be performed in order to ensure that the ship is presented for dismantling in a clean and safe condition. Wastewater and any used solvents from the cleaning station must be contained and properly treated. All combustible liquids and materials are removed to make the vessel safe for hot work. This process will continue during the entire dismantling process (see next section). During removal, actions should include containment; whilst wet - booms should be placed around the ship, when dry - transfer arrangements (pumping/ pipe-work, etc.) should include arrangements for the containment of any leakage.

3. Securing

To ensure that working procedures and operations are undertaken in a safe manner, a process of securing the vessel is required. This should emphasis two aspects:

- Safe access to all areas, compartments, tanks, etc. ensuring breathable atmospheres
- Safe conditions for hot work, including cleaning/ venting, removal of toxic or highly flammable paints from areas to be cut, and testing/ monitoring before any hot work is performed

4. Removal of equipment

Consumable and loose equipment is removed first. Reusable components are removed as they become accessible. Fixtures, anchors, chains, engine parts and propellers are examples of components that are removed during this step.

5. Removal of hazardous/ polluting substances

The pre-prepared inventory identifies hazardous/polluting substances (asbestos-containing material, PCB-containing material, etc). These are carefully removed and disposed of as they become accessible. In cases where these substances are encased or enclosed in components or structural parts, removal can take place after these have been brought ashore.

6. Dismantling

A safe and practical cutting sequence is dependent upon which adopted method is used (dry-dock, moored, beached). A specific plan for an actual dismantling facility should be drawn up. This should form a base frame for the ship-specific dismantling plan.

7. Storage, recycling and disposal

The waste stream arriving from dismantling is sorted/ segregated, and materials for recycling are separated and prepared for processing. Hazardous wastes and other wastes must be stored and disposed of according to applicable laws and regulations.

The required procedures to be undertaken at the dismantling facility are illustrated in Table 1 (dismantling stages II and III).

4.2 Identification of potential contaminants and prevention of releases

Table 3 identifies substances most likely to be involved in releases from the dismantling process and elaborates on the challenges associated with the release of these substances.

The sources for potential releases mirror the actual state of the vessel to be dismantled at the time it arrives at the dismantling facility. Precautions to prevent releases should therefore include relevant vessel-related measures and not only to those relevant for the actual dismantling process (steps 1 to 4 under chapter 4.1).

Requirements for processes of removing identified substances

There is currently no purpose-made international legislative framework covering ship demolition processes. There are however various standards, norms, regulations and international conventions that may have relevance within certain segments of the processes involved. These may have applications to environmental matters, to safety issues and to aspects of health, occupational nature and general employment rights.

4.2.1 Metals

The ship is cut apart for the recovery of various materials, including different kinds of scrap metal. Steel scrap represents the largest recyclable fraction of the ship. Scrap metal can be broadly classified as ferrous scrap, of which the largest proportion is so-called "carbon steel", and non-ferrous scrap, which comprises scrap of particular interest due to its relatively high value.

Hazards

Torch-cutting is the most common way of extracting the metal structure and enabling practical handling for further treatment. During the process, large amounts of fumes, smoke, particulates (including manganese, nickel, chromium, iron, and lead) and material chippings (debris) are generated. Furthermore, torch-cutting falls into the category of "hot work" and consequently, specific requirements to the surrounding atmosphere are required.

Emissions from metal cutting are more likely to contain air pollutants which have toxic effects on the workers, exposing their health to risk rather than having a major air quality impact. The facility should identify measures of protection for these cutting operations, both to avoid the spreading of the contaminants as well as protecting the workers.

Metal exposure through consumption of contaminated seafood may cause health problems. This is particularly a problem in areas where workers live nearby ship-dismantling facilities and where seafood is an important source of nutrition.

Precautions

Prior to any "hot work" activities, surface coatings should be assessed and removed (in the cutting line), if found to be toxic or highly flammable. All spaces where torch-cutting is to be conducted, should be clarified as "safe for hot work" prior to start-up. This includes areas within, on or adjacent to spaces that contain or have contained combustible or flammable liquids or gases, as well as accessories connected to spaces that contain or have previously contained fuel.

An area or space is "safe for hot work" after concentrations of flammable vapours or gases in the atmosphere are declared to be less than 10 percent of the lower explosive limit. Further, hollow metal containers must be filled with water or be thoroughly cleaned of flammable substances, vented and tested prior to cutting. Sufficient ventilation (through-flow) is required for each hollow structure for the release of any pressure build-up that might occur during heating.

Workers performing any type of metal cutting may be exposed to damaging bright light, ricochets, noise and heat. This requires the use of personal protective equipment (PPE) including suitable eye protection as well as appropriate hand and body protection. Clothing must not contain flammable material, and all fire hazards must be moved away from the object to be cut. Workers subjected to noise levels of a certain magnitude must use appropriate equipment reducing the exposure to an acceptable level.

The workforce may conduct general metal cutting without mechanical ventilation or respiratory equipment, provided that it is not done in a confined or enclosed space and that metals containing or coated with toxic materials are not being cut. If sufficient ventilation is not feasible (to arrange) when metal cutting is performed in confined spaces, the workers must then use air-line respirators. Furthermore, someone outside the confined space must maintain communication with the workers inside in order to provide assistance and/ or alert in case of an emergency. Workers cutting metals that contain or are coated with toxic materials, must use local exhaust ventilation or air-line respirators.

Waste handling

The dismantling facility may recycle scrap metal by selling it to a resmelting/ re-rolling company or a scrap metal broker. It is important to note that coated scrap metal that is not recycled should be managed and disposed of as hazardous waste. Recyclable metal that is intermixed with non-metallic material can be recovered by the use of shredders and separators. The remaining non-recoverable non-metallic materials from the shredding process must be disposed of as hazardous waste as they may contain environmentally hazardous substances, such as asbestos or PCBs. Scrap metal for recycling exported from the dismantling facility may be contaminated by considerable amounts of coating products containing toxic or hazardous substances. Receivers of scrap metal for re-processing should be encouraged to take action in order to safeguard against pollution.

Cable-burning for the recovery of copper wire is highly hazardous and must be prevented. Operators are strongly encouraged to separate copper from cable insulation by other means. Cable insulation should be considered to contain hazardous substances or substances capable of producing hazardous substances upon disposal (Basel Annex III, H13) and treated accordingly if not confirmed otherwise.

Anodes are fitted to both the vessel's hull and inside tanks in order to protect against corrosion and fouling. Anodes consist mainly of aluminum (Al) and zinc (Zn), but may also include small amounts of other metals, such as copper (Cu), iron (Fe), and mercury (Hg). Anodes are sacrificed over a space of time and the amount of metals left when the ship arrives for dismantling will reflect its history of maintenance. It is likely that most (intact) anodes will be extracted and sorted for reuse/ resale. Heavily corroded anodes will be disposed of as hazardous waste. The removal of the anodes will in itself not generate any adverse effects on humans or the environment as alloys are non-toxic in their solid states.

Lead (Pb) is toxic, and can be found in batteries, paints and in components in motors, generators, piping, cables and others. The detrimental effects of lead upon human health have been widely known for a long time. Young children are most susceptible to the toxic effects of lead. Long-term exposure to even low levels can cause irreversible learning difficulties, mental retardation and delayed neurological and physical development. In adults, exposure to lead primarily affects the peripheral nervous system and can cause impairment of hearing, vision, and muscle co-ordination. Lead can also damage the blood vessels, kidneys, heart and reproductive system.

Lead chromate (present in paint pigments) is documented as a carcinogen both to humans and other organisms. It may also damage embryo development and cause infertility.

Improper disposal of batteries and paints containing lead can cause a threat to health as well as to the environment.

Mercury is a toxic heavy metal and a persistent, bioaccumulative pollutant that affects the nervous system. On board ships, mercury can be found in thermometers, electrical switches, light fittings and luminescent lamps. Accidental spills of mercury can lead to dangerous mercury exposure. Consumption of contaminated fish is also an important source of mercury exposure. Mercury must be handled as hazardous waste.

4.2.2 Oil and fuel

Onboard location

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. System oils are typically located in engine room sump tanks, whilst cylinder oils may be stored in separate purpose tanks. Lubrication/ system oils may also be stored in drums. Tankers can arrive at the ship-dismantling facility with a significant quantity of cargo residues. Further, all tanks may contain a certain level of sludge.

Hazards

Both petroleum products and non-petroleum oils can have adverse and well-documented effects on the environment. Oils and fuels may poison marine organisms and physically soil the environment (birds, fish, plants, etc.). Oil spills also threaten natural resources.

The primary danger to workers handling oil and fuel on ships is that of fire and explosions. It should also be noted that oil and fuel represent certain toxic hazards and may impose serious health threats to workers if handled incorrectly. The main exposure routes for the hazardous components in oils and fuels are inhalation and consumption of contaminated fish and water. Highly refined petroleum products are toxic and also represent a fire hazard.

Waste handling

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, in addition to a leakage-collection arrangement. The monitoring should include record-keeping. It should be noted that local/ national regulations may require notification to authorities concerning installation and usage for the storage of flammable or combustible liquids. Regulations may also address the issues of fire-protection and financial responsibilities.

Used oil may be defined as oil that has been refined from crude oil or made from synthetic materials and which contains physical or chemical contaminants as a result of being used. 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". 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), must be managed according to governing national hazardous waste regulations.

A facility for ship dismantling may have to handle significant amounts of oils. This requires the establishment of an oil spill preparedness contingency plan that includes instructions on notification, recovery and normalisation. The plan should be integrated in the general Contingency and Preparedness Plan (CPP) for the facility (see chapter 6.2).

4.2.3 Bilge and ballast water

Onboard location

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. It is critical to safe operations and can involve vast quantities as cargo holds are often used for ballast water on older ships (those typically being sent to the recycling yards). More modern ships have segregated ballast tanks, but even those may need cargo hold ballast to withstand rough weather. Further, an empty ship would need larger amounts of ballast water for safe transport to the recycling yard whether being towed or steaming under its own power. Ballast water can be found in various tanks throughout the ship. The development of an International Convention for the Control and Management of Ships Ballast Water and Sediments is in progress under the IMO.

Hazards

Bilge water is often referred to as oily waste as it is usually heavily contaminated with oil and cargo residues, in addition to other pollutants (inorganic salts, and metals, such as arsenic; copper; chromium; lead; and mercury). Given this, bilge water presents an oil pollution hazard during cutting operations.

Ballast water may contain pollutants, such as residual fuel, cargo hold residues, biocides, oil and grease, petroleum hydrocarbons, and metals (e.g. iron, copper, chromium, nickel, and zinc). Ballast water in cargo tanks (oil) is referred to as dirty ballast water.

The transport of large volumes of water containing organisms from shallow, coastal waters across natural oceanic barriers can cause massive invasions of neritic marine organisms. Because ballast water is usually taken from bays and estuaries with water rich in animal and plant life, most ships carry a diverse assemblage of aquatic organisms. Aggregate sediments typically found in ballast tanks will contain living species which reflect the trade history of the vessel.

The arrival condition of the dismantling candidate is most likely that of “in ballast”. The discharge of ballast water/ sediment species into the coastal sea-area may be a potential source for introducing unwanted organisms which threaten the ecological balance in the surrounding seas and thereby represent a direct threat to biodiversity. Ballast water can be the carrier of viruses and bacteria transferred to humans causing epidemics.

In order to limit the biological threat represented by the introduction of invasive species via ballast water, the vessel should undergo recommended de-ballasting in accordance with IMO Assembly Resolution A.868(20): “Guidelines for the control and management of ships ballast water to minimise the transfer of harmful aquatic organisms and pathogens”, unless other regulations apply.

Waste handling

Bilge and ballast water may be transferred to onshore storage tanks, evaporation pits (ballast water only) or discharged directly overboard. Regulations apply that specifies 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.

4.2.4 Paints and coatings

Onboard location

A comprehensive selection of different paints and coating products are present on board a vessel. These products are used both on the exterior and the interior and may have characteristics requiring certain precautions with respect to the demolition process. The hull is coated several times during its lifetime in order to prevent fouling. Fresh paint for maintenance purposes may also be found on board.

Hazards

Paints can be flammable and may contain toxic compounds (PCBs, heavy metals (e.g. lead, barium, cadmium, chromium, and zinc), and pesticides). Paints with metallic compounds are used to protect ship surfaces from corrosion. Pesticides, such as tributyl tin (TBT) and organotin are still commonly in use on wetted hull surfaces in order to prevent fouling.

The removal of paints prior to cutting during ship dismantling may not be necessary unless the process leads to the release of toxic compounds or if the paint is highly flammable. Prior to cutting painted surfaces, the dismantling facility should conduct an evaluation to determine flammability and toxicity of the paint or coating. Toxic or flammable painted/ coated steel should be labelled following cutting. Flammable paints or coatings may be burned away in a controlled manner. This process requires that provisions for fire-fighting have been made.

Toxic paints or coatings should be removed at a distance of some 10 cm from the area to be cut. If removal is not possible or feasible, cutting can proceed provided that the operator(s) are equipped with respiratory protective equipment such as air-line respirators. Three methods are commonly used to remove paints and coatings:

- *Chemical stripping*. The application of solvents. Note that solvents are in their own right, usually hazardous and will present a use and disposal challenge.
- *Abrasive blasting*. A surface is blasted with abrasives (slag, grits or steel shots). Blasting involves the use of high-pressure equipment and may potentially be dangerous if the condition of the equipment applied is not satisfactory. Periodic checking of pressure equipment/ tools should be mandatory. Workers'skin, eyes and hearing are particularly exposed. Abrasive blast material is a hazardous waste if the material includes hazardous coating residues or is made from slags contaminated with arsenic, lead or cadmium.
- *Mechanical removal*. Power tools or thermal tools may be applied. Thermal removal must not be used on paintwork containing PCB.

The methods above may generate emissions containing compounds of concern, which are also associated with the potential for causing cancer. The main exposure route from paint removal is inhalation. Paint removal activities also generate large amounts of hazardous waste.

Most paints and coatings will be exported from the dismantling facility to steel reprocessing plants via steel plates. Consequently, the challenges associated with emissions of polluting substances in the paints and coatings are transferred to the reprocessing facilities where air emissions may be easier controlled. The labelling of steel plates will enable the reprocessing plant to undertake certain measures in order to control the air emissions.

See section 4.2.6 for localisation and handling of PCB-containing materials.

Tributyl tin (TBT) is an organometallic substance used in anti-fouling paints. It can cause an effect at low to sub-nanogram quantities per litre, and is therefore considered to be one of the most toxic compounds in the aquatic environment. Its use is now strictly controlled in most parts of the world. When a vessel is beached, there will be direct contact between the ship's hull and the beach, and some anti-fouling will be ground up. High concentrations in beach sediments would be expected from this process. The antifouling residue is deposited in the sediment or carried away with the current thereby causing pollution in the marine environment.

Note that a proposed ban on the use of TBT in antifouling coatings is expected to enter (in full) into force in 2008 (ref. IMO's "International Convention on the Control of Harmful Anti-Fouling Systems").

Isocyanates are often used in spray-painting and polyurethane coating processes and may be released when hot work is applied. Occupational exposure can cause respiratory diseases and asthma. The exposure levels likely to be generated by ship-dismantling activities are unknown.

Waste handling

Waste from these processes can also have negative impacts on the environment. Remains generated from the paint and coating removal processes should be considered hazardous and should be managed and disposed of accordingly. Procedures must be identified in the waste management plan for the facility. This should also identify best-management practices to prevent or minimise pollution from surface runoff water.

The waste management plan will be facility-specific as different facilities vary in size and location, hydrogeology, climate, environmental setting, and so on. Paint removal wastes (including contaminated or residues of solvents and sludges, solvent-contaminated rags, abrasive residues and paint chips) that are defined as hazardous waste, either by appearing on a defined hazardous waste list or by having hazardous waste characteristics (ignitable, corrosive, reactive or toxic), must be managed according to the national hazardous waste regulations.

4.2.5 Asbestos

Onboard location

Asbestos-containing material (ACM) may be found in thermal system insulation and on surfacing materials. Engine rooms usually contain the most asbestos. Some other applications may also be found. ACM is often visible, but can also be found underneath other materials that do not contain asbestos.

Hazards

Asbestos is a natural mineral which is not harmful to the environment per se, but which nonetheless represents a major health threat. When ACM is deteriorated or disturbed, asbestos breaks up into very fine fibres which can be suspended in the air for long periods and possibly inhaled by workers and operators at the facility or by people living nearby. The most dangerous asbestos fibres are too small to be visible. Once they are inhaled, the fibres can remain and accumulate in the lungs. Breathing high levels of asbestos fibres can lead to an increased risk of lung cancer, mesothelioma (a cancer of the chest and abdominal linings), and asbestosis (irreversible lung scarring that can be fatal). The risk of lung cancer and mesothelioma increases with the number of fibres inhaled. Symptoms of these diseases do not show up until many years after exposure. Most people with asbestos-related diseases have been exposed to elevated concentrations in connection with their work.

Waste handling

Asbestos is listed in Annex VIII (List A) of the Basel Convention, and is consequently a hazardous waste. Thus asbestos should not be re-used or re-cycled. 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. If national requirements do not address these areas, the facility is recommended to implement an asbestos disposal plan in the waste management plan. This should include requirements associated with the ship's inventory plans so that asbestos can be localised, quantified and identified prior to removal. Further, the plan should identify PPE 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. Handling of asbestos should be monitored by record keeping as well as by sampling. 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.

Monitoring should include air-surveillance activities to be performed in work areas where asbestos is being removed. The record-keeping should include all measurements taken to monitor worker-exposure to asbestos.

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 must provide hygiene facilities for workers, such as decontamination areas (equipment room, shower area and clean room) and dining areas.

If a shipboard 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 landfill (burying it in the ground).

4.2.6 PCBs

Onboard location

PCBs may be found in both solid and liquid forms in equipment and materials throughout the ship. Since the sampling and determination of the presence of PCB's is a difficult process, a so-called Grey List has been set up listing suspect materials and equipment, which may contain PCB's.

Grey List of suspected PCB-containing materials	
• Cable insulation • Rubber and felt gaskets • Thermal insulation material including fibreglass, felt, foam and cork • Transformers, capacitors (also contained in electronic equipment) • Voltage regulators, switches, reclosers, bushings and electromagnets • Adhesives and tapes	• Oil, including that contained in electrical equipment and motors, anchor windlasses, hydraulic systems • Surface contamination of machinery and other solid surfaces • Oil-based paint • Caulking • Rubber isolation mounts • Foundations mounts • Pipe hangers • Light ballasts • Plasticizers

Hazards

PCBs are toxic and persistent in the environment and have been shown to cause a number of adverse health effects. The most carcinogenic PCBs tend to bioaccumulate. Exposure to PCBs may occur through inhalation, ingestion, or absorption through the skin. The toxicity of chemicals produced when PCBs are heated (polychlorinated dibenzofurans and polychlorinated dibenzo-p-dioxins) is of special concern, as they are believed to be even more toxic than PCBs themselves.

Waste handling

Workers removing and disposing of PCBs or PCB-containing materials must use appropriate personal protective clothing or equipment that protects against dermal contact with or inhalation of PCBs. Removal and disposal of PCB-containing materials 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.

The production of PCBs in the USA ceased in 1979 following new regulations. In Europe, most countries banned the manufacturing of PCB in the early 1980s (1978-1982) and phase-out regulations on use of PCB are in place. A global campaign aiming at prohibiting all use of PCB is ongoing. International trade of PCB is regulated in the Rotterdam Convention and under the Stockholm Convention.

Wastes containing PCBs at a concentration level of 50 mg/kg or more are considered hazardous waste by the Basel Convention. As a precaution, it may be feasible to remove all known and suspected PCBs and PCB-containing material, or conduct sampling and chemical analysis of these items, and if regulated PCB levels are present, dispose of them according to the criteria set forth in Article 6 of the Stockholm Convention.

Article 6 of the Stockholm Convention stated the following:

Measures to reduce or eliminate releases from stockpiles and wastes

1. In order to ensure that stockpiles consisting of or containing chemicals listed either in Annex A or Annex B and wastes, including products and articles upon becoming wastes, consisting of, containing or contaminated with a chemical listed in Annex A, B or C, are managed in a manner protective of human health and the environment, each Party shall:

(a) Develop appropriate strategies for identifying:

(i) Stockpiles consisting of or containing chemicals listed either in Annex A or Annex B; and
(ii) Products and articles in use and wastes consisting of, containing or contaminated with a chemical listed in Annex A, B or C;

(b) Identify, to the extent practicable, stockpiles consisting of or containing chemicals listed either in Annex A or Annex B on the basis of the strategies referred to in subparagraph (a);

(c) Manage stockpiles, as appropriate, in a safe, efficient and environmentally sound manner. Stockpiles of chemicals listed either in Annex A or Annex B, after they are no longer allowed to be used according to any specific exemption specified in Annex A or any specific exemption or acceptable purpose specified in Annex B, except stockpiles which are allowed to be exported according to paragraph 2 of Article 3, shall be deemed to be waste and shall be managed in accordance with subparagraph (d);

(d) Take appropriate measures so that such wastes, including products and articles upon becoming wastes, are:

(i) Handled, collected, transported and stored in an environmentally sound manner;

(ii) Disposed of in such a way that the persistent organic pollutant content is destroyed or irreversibly transformed so that they do not exhibit the characteristics of persistent organic pollutants or otherwise disposed of in an environmentally sound manner when destruction or irreversible transformation does not represent the environmentally preferable option or the persistent organic pollutant content is low, taking into account international rules, standards, and guidelines, including those that may be developed pursuant to paragraph 2, and relevant global and regional regimes governing the management of hazardous wastes;

(iii) Not permitted to be subjected to disposal operations that may lead to recovery, recycling, reclamation, direct reuse or alternative uses of persistent organic pollutants; and

(iv) Not transported across international boundaries without taking into account relevant international rules, standards and guidelines;

(e) Endeavour to develop appropriate strategies for identifying sites contaminated by chemicals listed in Annex A, B or C; if remediation of those sites is undertaken it shall be performed in an environmentally sound manner

2. The Conference of the Parties shall cooperate closely with the appropriate bodies of the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal to, inter alia:

(a) Establish levels of destruction and irreversible transformation necessary to ensure that the characteristics of persistent organic pollutants as specified in paragraph 1 of Annex D are not exhibited;

(b) Determine what they consider to be the methods that constitute environmentally sound disposal referred to above; and

(c) Work to establish, as appropriate, the concentration levels of the chemicals listed in Annexes A, B and C in order to define the low persistent organic pollutant content referred to in paragraph 1(d)(ii).

PCBs or PCB items to be stored must be placed in proper containers, covered and labelled. Temporary storage facilities for PCB-containing waste must have a floor-covering that prevents penetration of PCBs and a curbing that provides sufficient containment volume in the case of a spill, roof and walls that prevent rainwater from reaching the wastes, and no floor drains or other openings that would allow liquids to flow from the area. Disposal requirements may be dependent upon the nature of the source and its concentration.

4.2.7 Other waste streams

Radiation sources. Radioactive material may be present on board a ship in liquid level indicators, smoke detectors or emergency signs. These sources generate low-level radioactive waste, but handling and disposal of such waste is usually strictly regulated. Ionizing radiation is hazardous to human health and the environment and can cause severe forms of cancer and/ or damage to genetic material endangering future generations. Any release of radioactive material could increase the radiation exposure to the population and must therefore be avoided.

Timber can be found in furniture or walls, and timber may for example contain preservation or paint that could have an adverse effect on the environment. The timber should be treated according to national regulations and should be taken care of by approved waste companies.

Polyvinyl chloride (PVC) is used in a wide variety of products for different applications and is commonly found in cables, floor coverings and plastic devices of different types. PVC products may contain more than 50% chlorine, and may contain environmentally hazardous additives. A complex mixture of fumes and gases is generated when PVC is burned, depending on the oxygen availability and other fire conditions. This includes carbon monoxide and dioxins. Indeed all open burning may generate toxic gases and should therefore be prohibited, but PVC is of particular concern because of the chlorine content. Also, large quantities of hydrogen chloride gas are generated when PVC is burned. The hydrogen chloride gas combines with water to form hydrochloric acid in the lungs.

Batteries can contain heavy metals such as Pb, Cd and Ni. Lead-acid batteries also contain sulphuric acid, which is corrosive and can cause severe burns. Batteries can be in flashlights, mobile radios and electrical equipment, but the largest volume of batteries (lead-acid batteries) is found in radio applications, intercoms, fire alarms, emergency start equipment and lifeboats. Batteries in working order will most often be sorted and sold for reuse. Lead alone represents a considerable value, and there is therefore reason to believe that batteries are recycled regardless of their condition. If batteries are undamaged, they will not have an environmental effect. However, the improper storage or disposal of batteries can cause a threat to human health and the environment.

Freon is a Du Pont trade name for chlorofluorocarbons (CFC), which are compounds consisting of chlorine, fluorine and carbon. CFCs are non-toxic, non-flammable compounds that are stable in the troposphere, but in the stratosphere, can be broken down by UV light and deplete the ozone layer. CFCs are used as refrigerants, solvents and foam-blowing agents. Shipborne CFCs have been believed to contribute to up to 10% of global emissions. The United States, Canada, and the Scandinavian countries imposed a ban on the use of CFCs in aerosol-spray dispensers in the late 1970s. In 1987, 27 nations signed the Montreal Protocol, which is a global environmental treaty on reducing substances that deplete the ozone layer. Several amendments have followed, and the use of CFCs, some chlorinated solvents and Halons (chemicals used as fire extinguishing agents) should therefore become obsolete within the next decade. These products and restrictions associated with their use are also addressed in MARPOL (Annex VI).

Other chemicals

Other chemicals/ substances/ components that may require special handling are for example:

- Antifreeze fluids
- Solvents/ thinners
- Battery electrolyte
- Evaporator dosing and de-scaling acids
- Corrosion inhibitor
- Compressed gases (acetylene, propane and butane)
- Plastics, as covered by MARPOL
- Boiler/ water treatment chemicals
- Kerosene/ White Spirit
- Anti-freeze compounds
- Engine additives
- Flame retardants
- Miscellaneous chemicals, such as alcohols, methylated spirits, epoxy resins, etc.

The chemicals/ substances/ components above may have negative effects on the environment. They may represent a market value and some are therefore sold on for further use. Their characteristics are not addressed any further in these guidelines.

4.3 Monitoring

In cases where well-defined discharge regulations are implemented, efficient monitoring may be limited to verifying compliance to these regulations. Where no such discharge regulations exist, the monitoring strategy may include recommendations as described in this subchapter and in chapter 4.4.

Releases

Releases from dismantling of ships may be divided into four main categories:

1) Releases to ground and sediments
2) Releases to water
3) Emissions to air
4) Noise/ vibrations

Typical types of release within the categories are summarised below. The sources for these releases can be found in Table 3.

- Releases to water and ground:

  Fuel oils; lubrication oils; hydraulic fluids; polluted waters; cargo residues; sludges; PCB-containing materials; heavy metals; harmful aquatic substances; paints and coating that may contain toxic compounds, radiation sources, asbestos-containing materials

- Emissions to air:

  Asbestos-containing materials, PCB-containing materials (dioxins are emitted when PCB is heated); volatile organic compounds (VOCs); particulates (containing i.a. lead or other metals, from metal cutting), toxic fumes

Quantification of these releases is difficult since many factors affect them. However, an attempt has been made to quantify the types of release relative to each other. The ranking of materials is on the basis of the quantities released and is not intended as an assessment of the relative risk of release from the listed materials:

Metal scrap:	*****
Oil and fuel:	***
Bilge and ballast water:	***
Paints and coatings:	**
Asbestos:	**
PCBs:	*

Surrounding environment

A monitoring programme must be established for the surrounding ground/groundwater, seawater/sediments and air, in addition to noise/vibrations that could affect the surrounding environment. The purpose of the monitoring programme is to establish the state of the environment surrounding the ship dismantling facility.

The monitoring programme should reveal chemical, biological and physical changes in the environment surrounding the site of interest. The changes could be the results of natural events/variations, but are in most cases the result of human activity.

In order to reveal changes in the environment, a background study should be conducted before the site of interest is disturbed. If the ship dismantling facility is already established, it is too late to find background data for this site, so other reference stations should be used for future comparison. A good reference station is located as far away from any pollution source as possible but should have similar geological and meteorological conditions as the site of interest.

The selection of monitoring stations, the sampling frequency and the choice of parameters to be analysed are site-specific and are dependent on the hydrology and meteorology in the area. Adjustments in the monitoring programme will be necessary from time to time in order to optimise the sampling design. It is also important to evaluate possible contribution from other polluting industries or activities in the area that could affect the pollution level at the monitoring stations.

There should be accredited standards (or at least nationally approved standards) for the sampling and analysis of relevant parameters. The standards are specific for the media sampled (soil, sediments, water or air) and contain detailed procedures for example for sampling technique, type of sampling equipment, calibration of instruments, chemical analysis and detection levels. There are also standards for the analysis of other materials and matrices. It is important that the procedures for sampling and analysis are followed so that the data obtained is comparable. For the same reason, only accredited laboratories should be used for chemical analysis.

All monitoring programmes must be site-specific. However there are certain elements that must be included in the programmes. In the following sub-chapters the general content of such programmes is outlined.

Sediments/ soil

A monitoring programme for sediments (soil under water) and for soil should include sampling locations; sampling depths; sampling technique; selected parameters; procedures for storage and analysis of the samples; sampling frequency and reporting.

Sediment and soil samples are collected using special corers, and the cores are later divided into slices. For sediments, this indicates the current and previous load to the area for stable elements or elements that have a known degradation rate, whereas for soil samples, it will indicate how the polluting elements have spread. Lead (Pb_{210}) is often used to date marine-sediment samples, since the degradation is known.

Components that are most likely to be released to soil and/or sediments from a ship-dismantling facility are hydrocarbons, heavy metals, PCBs, biocides (e.g. TBT), and cargo residues. These should be included in the initial monitoring plan. Adjustments will most likely be necessary to provide for site-specific requirements.

During sediment sampling it is important to simultaneously record the physical properties (wind-speed and direction, currents, wave action etc.) which can spread and dilute the substances being investigated. For soil investigations, knowledge of the local geology and hydrology is essential.

In addition to regular chemical investigations, biological communities in marine sediments are often used as pollution indicators, since they are relatively stable over time. Single or multiple species can also be investigated for different pollutants (animals often bioaccumulate environmentally harmful compounds) in order to assess food quality (on land this is mostly done by investigating crop quality).

Water/ seawater

A monitoring programme for water should include sampling locations, sampling depths, sampling technique, sample preservation, selected parameters, procedures for storage and analysis of the samples, sampling frequency and reporting.

Suggested parameters for analysis are as follows: hydrocarbons, heavy metals, PCBs, biocides (e.g. TBT), and cargo residues. Values of pH and temperature should also be monitored. These parameters will affect the state of the chemical compounds present in the body of water.

Water samples from lakes, rivers or the sea are collected at certain depths using a suitable water collecting device (type is usually specified according to the procedure used).

For groundwater investigations it may be necessary to drill wells, if there are no wells already available at the desired locations.

In order to interpret results from water investigations, it is important to have some knowledge of the local hydrology (for freshwater investigations) and hydrography (for seawater) such as currents, temperature/salinity profiles and tidal movements.

Air

The air quality monitoring programme must include the location of the monitoring stations, parameters, sampling procedures specific for each parameter, procedures for the analysis, and reporting.

The monitoring stations should be located at the residential area closest to the ship dismantling facility, or preferably, the nearest residential area down-wind from the ship dismantling facility. Initially, the following parameters should be monitored: volatile organic compounds (VOCs), particulates, metals (as particulates and gases), asbestos fibres, PCBs and dioxins. However, this may be adjusted later in accordance with previous measurements and an evaluation of the local air quality in general.

It is important to record the meteorological conditions during the air sampling, since these will greatly affect local air quality. A meteorological monitoring station should therefore be established, if there is not already one in the vicinity, that has the same prevailing wind directions and precipitation load.

Noise/ vibrations

Ongoing varying types of dismantling activities will result in noise and vibrations.

The monitoring programme for noise and vibrations must include location of the monitoring stations, detailed procedures for the measurements, frequency of measurements, and reporting.

The monitoring station for noise and vibrations should be located at the dwelling closest to the ship dismantling facility.

Meteorological conditions should also be recorded as they may affect the spread of noise. The highest noise level will most likely be measured at a monitoring station located down-wind from the ship dismantling facility.

Influence from other sources in the area (e.g. traffic, industry) should be evaluated, since these could affect the resulting noise level at the monitoring stations.

4.4 Setting standards/ limits

Health issues - control of exposure to hazardous wastes

For an ESM of a ship dismantling facility, it is imperative that containment of releases that cause specific health hazards is done systematically within the context of a carefully defined exposure control strategy. To this end, reference levels for the exposure to hazardous wastes have to be agreed upon and observed, and a careful assessment should be made of the exposure risks during ship-breaking activities.

(a) Reference levels - ambition levels for exposure reduction

The starting point should always be that exposure to hazardous materials and wastes should be avoided or minimised. In practice it may be the case that complete avoidance is not feasible, and that a certain degree of exposure is expected.

In that case, local regulation or international norms should determine the limits for permissible degrees of exposure. Since each country may have its own legal codes, the reference levels for exposure will vary from country to country. A legal or safe limit may not be exceeded.

The choice of legal limits is often a matter of risk assessment: What is an acceptable risk of exposure? Risk being defined as the product of the level of exposure and the (quantified) consequences of exposure.

(b) Exposure assessment

Before a waste control strategy is to be defined, a general assessment of exposure risks in the ship dismantling facility should be made for the various waste streams. The following flow chart may help in the assessment and evaluation of potential exposure risks (see Figure 4).

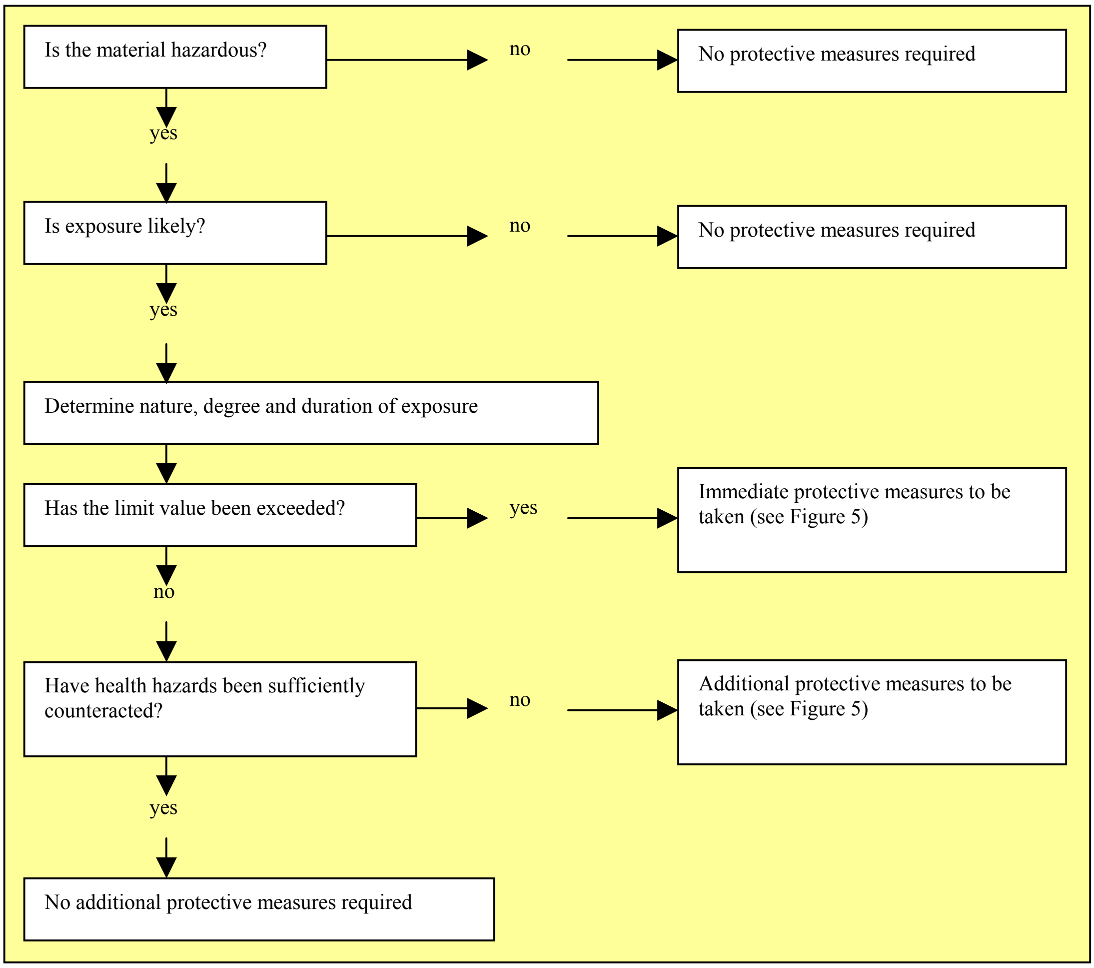


Figure 4 Exposure assessment

(c) <u>Exposure control strategy</u>

When exposure levels exceed legal limits, measures have to be taken to reduce the level of exposure to below the legal limits. Furthermore, when it turns out that exposure levels which are below the legal limits still generate certain health risks, additional measures will still have to be taken to minimise risks to the highest possible level.

Local legal regulations may stipulate that the management of a ship dismantling facility is compelled to make an inventory of and implement appropriate measures. This must not be done randomly: there is a clear hierarchy in "levels" of measures. Measures are to be assessed and implemented in a prescribed order of priority.

Levels of Control

Measures must be taken as close to the source as possible. A control measure at the source is the first order of measure. Descent to a lower level measure is only permitted if the realisation of the higher level measure is not possible/ feasible.

The levels of control measures to be considered are the following:

1st level: Measures at the source
2nd level: Compartmentalisation and isolation
3rd level: Application of personal protective equipment (PPE)

A systematic overview of the procedure to be followed when defining exposure control measures is schematically depicted in Figure 5. Exposure control measures in dealing with hazardous wastes

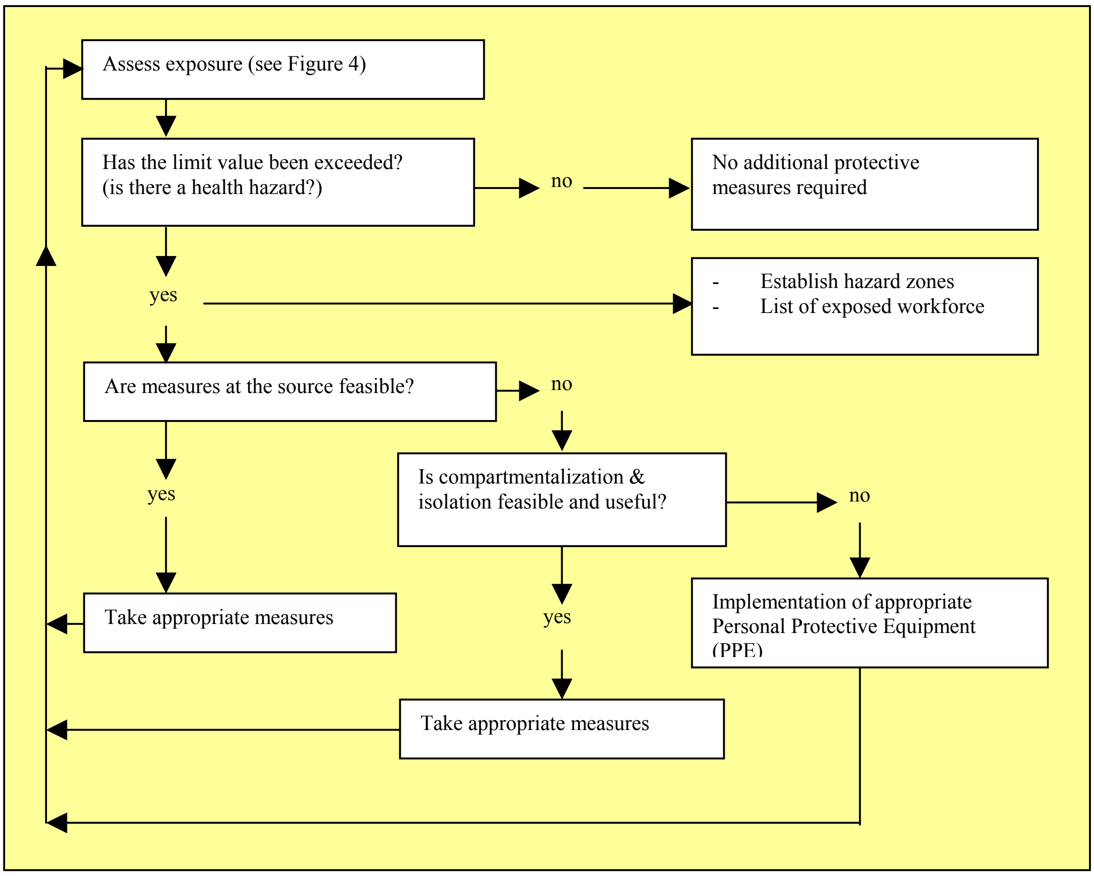


FIGURE 5 Exposure control measures in dealing with hazardous wastes

4.5 Incidents, accidents and contingency preparedness

Incidents, accidents and contingency preparedness should be accounted for under separate procedures, a Contingency Preparedness Plan (CPP), as a part of the Environmental Management System (see chapter 6.2). For the preparation of the CPP, reference should be made to UNEP/OCHA's "Guidelines for the development of a national environmental contingency plan". According to the above-mentioned guidelines, an environmental contingency plan would essentially provide the following information:

(a) assignment of the duties and responsibilities among the authorities, participating agencies, the response team and co-ordinators and/or those responsible for the pollution incident;

(b) relationship with other contingency plans;

(c) a reporting system that ensures rapid notification in the event of a pollution incident;

(d) the establishment of a focal point for co-ordination and directions connected to the implementation of the plan;

(e) response operations; should always cover these four phases:

I Discovery and alarm
II Evaluation, notification and plan invocation
III Containment and countermeasures
IV Cleanup and disposal

(f) identification of expertise and response resources available for assistance for the implementation of the plan;

(g) directions on the necessary emergency provisions applicable to the handling, treatment or disposal of certain pollutants (based on a survey of possible releases, see Table 3 for typical releases from ship dismantling facilities);

(h) link to the local community for assistance, if necessary; and

(i) support measures, such as procedures for providing public information, carrying out surveillance, issuing post incident reports, review and updating of the plan, and periodic exercising of the plan.

Emergency response

Dismantling activities at the ship dismantling facilities may result in several incidents and accidents, which may cause several types of damage. For example oil residues and vapours may represent a fire/explosion hazard during cutting, and falling objects may result in a variety of cutting injuries.

Good practice at these sites involves a survey of potential incidents and accidents to be carried out. Based on this, a plan for response to incidents, injuries and emergencies should be prepared. Response to emergencies should ensure that:

- the exposure of workers should be limited as much as possible during the operation
- contaminated areas should be cleaned and if necessary disinfected
- impact on the environment should be as limited as possible

Written procedures for different types of emergencies should be prepared and all the workforce should be trained in emergency response. All relevant emergency response equipment should also be readily available. With regard to dangerous spills, associated clean-up and fire-fighting operations should be carried out by specially allocated and trained personnel.

Response to injuries

Based on a survey of possible injuries, a procedure for response to injuries or exposure to hazardous substances should be established. All staff should have a minimum of training to such response and the procedure ought to include the following:

- immediate first aid, such as eye splashing, cleansing of wounds and skin, and bandaging
- immediate reporting to a responsible designated person
- if possible, retention of the item and details of its source for identification of possible hazards
- rapid additional medical care from medical personnel
- medical surveillance
- recording of the incident
- investigation, determination and implementation of remedial action

It is vital that incident reporting should be straightforward so that reporting is actually carried out.

Response to spills

Normally, spills only require a clean up of the actual contaminated area. However, for certain substances, the spill may require immediate evacuation of the area.

A spill cleaning procedure which includes safe handling operations and appropriate protective clothing should be established. An example of a general procedure for spill cleaning is given in Table 7.

Table 7 General procedure for spill cleaning

Action no.	Description of action
1	Evacuate the contaminated area
2	Immediate eye and skin cleaning of exposed personnel
3	Inform designated personnel
4	Determine the nature of the spill
5	Provide first aid and medical care to injured personnel
6	Secure the area to prevent additional exposure of persons
7	Provide adequate protective equipment to personnel involved in clean up
8	Limit the spreading of the spill
9	Neutralise or disinfect the spill or contaminated area if necessary
10	Collect and rinse the spill and the contaminated area into appropriate bags and containers
11	Neutralise, disinfect and rinse the used equipment and personal protective equipment
12	Determine personnel injury status. If required, seek immediate medical assistance.
13	Monitoring and follow-up of the programme
14	Reporting

Reporting

All personnel should be trained in emergency response and be knowledgeable of appropriate procedures for the prompt reporting of accidents and incidents. Such reports should include:

- Nature of accident or incident
- Where and when it occurred
- Which staff were directly involved
- Other relevant circumstances

It is important that the procedures for reporting are simple and well-defined, to ensure that the reporting is actually carried out.

All accidents and incidents should be investigated by the responsible personnel in order to establish their cause and if possible take action to prevent recurrence. All records should be stored.

5. GOOD PRACTICE IN DESIGN, CONSTRUCTION AND OPERATION OF SHIP-DISMANTLING FACILITIES

5.1 Principles

Ship dismantling facilities are often located as integrated clusters of facilities. Note that a number of measures or recommendations to be implemented or adhered to, may be integrated in a system comprising the individual dismantling facility or a group of adjacent dismantling facilities.

Principle types of ship-dismantling facilities

Adopted ship dismantling principles differ by method applied to access the structures and is governed by the characteristics of the available site-type. The main site-types in use are:

- Beach dismantling facility
- Dry dock facility
- Mooring at pier
- Off-shore mooring and transportation by floating crane

Furthermore, the level of mechanisation between the different types varies considerably. In the case of beaching facilities, there is limited or no use of heavy lift cranes and specialised equipment; the work is in effect carried out by hand. There are also considerable variations in level of containment and methods of handling the waste streams. In general terms it can be assumed that beach facilities represent the lowest potential for ensuring proper containment whilst dry dock facilities represent the highest.

Despite the differences represented by different approaches to access the structures, the actual sequential procedures and hence required resources are similar for all dismantling facilities. Required resources or facilities can be grouped as follows:

I	Primary block breaking area;	Zone A
II	Secondary block breaking area;	Zone B
III	Finishing, assorting and overhauling areas;	Zone C
IV	Storage areas;	Zone D
V	Office buildings and emergency facilities;	Zone E
VI	Waste disposal facilities	Zone F

The sub-division into zones is relevant for the drafting of design guidelines and is descriptive for the required facilities.

The development of an environmentally sound dismantling facility should revolve around an understanding of the link between associated activities and the potential environmental threat they represent.

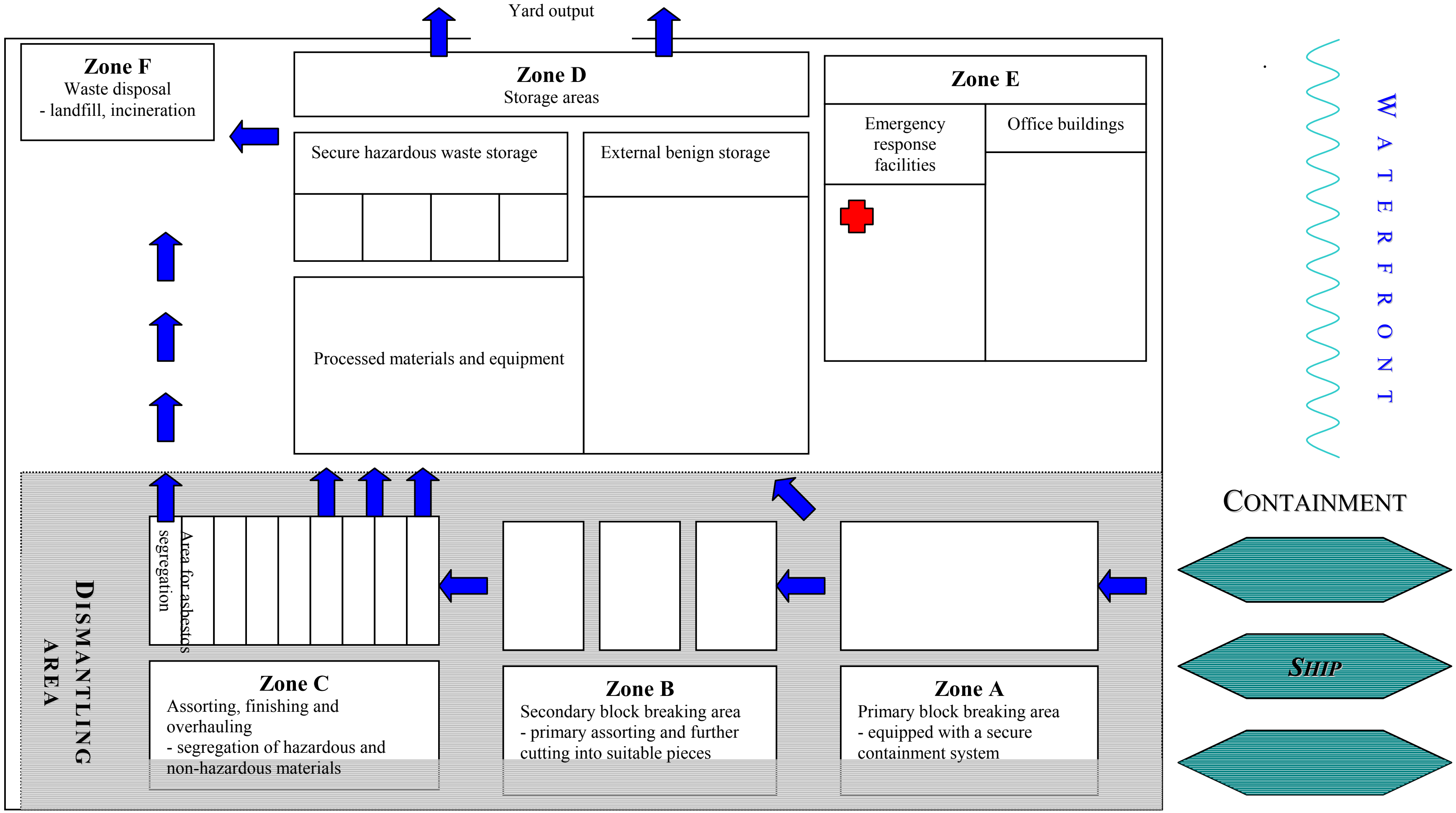


Figure 6 Conceptual illustration of a model ship-breaking yard

Current practices represent a variety of approaches to the challenges involved and do not comply to the requirements to facilities nor to methods adopted as identified in the following. An example of a model ship-dismantling yard is shown in Figure 6. Such a facility will comprise certain key functionalities:

- Workstations for secondary dismantling and sequential breakdown into component elements
- Hazardous and toxic materials removal requires specially-equipped workstations including the provision of appropriate containment
- Temporary storage areas for benign materials and steelwork
- Secure storage areas for hazardous waste
- Storage areas for fully processed equipment and materials that are ready for reuse, recycling or disposal
- Ships contain hazardous materials. Spills, leaks and releases will occur and no cleanup can remove 100% of them. Therefore, the most important environmental design aspect of any ship breaking yard are measures to contain releases to within the confines of the yard and then collect the spilled or released materials.

The model facility approach can be applied to new ship dismantling facilities. However for existing facilities suitable site specific modifications would be necessary.

Principle hazards

Hazardous releases in the ship dismantling process have been described in chapter 3.3 and chapter 4. Substances causing environmental hazards of principal concern are listed below:

- Oils and fuels
- Bilge and ballast water
- Paint and coatings
- Asbestos
- PCB's
- Others, e.g. anodes, radiation sources, lead, mercury, TBT, PVC[1], batteries, freon

In addition to the hazards described above, a great number of other potential hazards of a more general nature regarding health and safety can be identified:

- Exposure; heat/ noise/ vibrations/
- Working procedures, dangerous tools; saws/ cutters/ grinders/
- Accident factors; falling/ crushing/ electric shock/ non-breathable-/ explosive atmospheres/
- Quality control; reuse of ropes, chains recovered from ships/ cranes and lifting equipment/
- Contingency; availability - first-aid facilities/ fire-brigade/
- Accommodation; shelter (from the facility)/ clean water supply/ sanitary facilities/

A general lack of compliance to basic standards have been observed at many ship dismantling facilities allowing potential hazards as described above to develop into incidents. A significant reduction of incidents can be achieved efficiently by ensuring thorough enforcement of (usually existing) local labour regulations and compliance to standards/ norms.

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[1] Environmental impact associated with PVC normally refers to both the production of PVC and disposal by non-compliant incineration.

Only issues particular to the ship-dismantling industry, with potential “long-term” impacts on environment and health, have been addressed in these guidelines. One exception has been: the risk of explosion, primarily a “short-term” impact, but considering its potential consequences, it must be rated a principal hazard and should be included in when planning both the dismantling facility as well as when developing related management procedures.

5.2 Recurrence and prevention of principal hazards

In this section, a description of recurrence of principle hazards as described in Chapter 3.3 is given, and recommendations on methods to be applied to avoid or reduce these are provided. In identifying measures, efforts have been made to follow the strategy defined above (various levels of intervention), and to make a distinction between the various types of hazards (environmental, health, safety), and the different types of solutions (physical, operational). Some hazards can be reduced or even eliminated through proper planning, design and construction of the ship-dismantling facility, whilst others through implementation of effective and safe management and operational procedures. The former results in physical measures and is in principal a specific “one-off” activity. The latter incorporates operational measures, which must be implemented and enforced on a continual basis during the operation of the facility. In the following, physical measures are labelled with "P" and are described in more detail in paragraph 5.3. Operational measures labelled with an "O" are addressed in paragraph 5.4. Note that both physical and operational measures are in many cases interrelated.

Due to the high number of accidents caused by falling and moving objects, rigid helmets (hard hats) and hard-toed shoes should be required in most areas of a ship breaking yard.

Recurrence of predominant waste hazards

A hazard assessment involving the identification of type of procedures as a function of location (zone) and associated potential hazards, will form the very foundation for the design of the dismantling site and will enable physical precautions to be integrated. A generic assessment of hazards with reference to the model facility is presented in Table 8.

Table 8 Ship-breaking facility zones and associated activities and hazards

Zone	Activities	Environmental hazards	Health & safety hazards
Containment zone	- Initial containment	- as in column below	- as in column below
Zone A Primary block breaking area	- Removal of oil (sludge) and fluids - Dismounting of re-useable equipment - Cutting of large ship segments - Removal of asbestos and batteries - Emptying fire extinguishing systems, and CFCs from cooling systems	- Oil and fuel spills - Bilge and ballast water spills - Paint and coatings - Heavy metals - PCB - Others *	- Asbestos - Vapours (solvents and metals) - CO_2 - Risk of explosion - Radiation

Zone B Secondary block breaking area	- Primary sorting of components - Further cutting into suitable size for further transport	- Paint and coatings - PCBs - Others *	- Asbestos - Vapours - Risk of explosion
Zone C Assorting, finishing and overhauling areas	- Definitive sorting of materials and equipment - Segregation of composite materials - Finishing of materials for re-sale - Overhauling of equipment	- Oil and fuel spills - PCB - Others *	- Asbestos - Vapours
Zone D Storage areas	- Stockpiling of assorted, finished materials	- Oil and fuel spills - PCB's - Others *	- Asbestos - Risk of explosion
Zone E Office buildings and emergency facilities	- Administrative work - First Aid help (if not dealt with on the spot)		
Zone F Waste disposal facilities	- Landfilling - Incineration - Wastewater treatment	- Seepage of toxic liquids	- Toxic liquids - Asbestos

* "Others" represent i.a. anodes, radiation sources, heavy metals, TBT, PVC, batteries and freon.

A number of hazards recur several times in various zones of the ship-breaking yard. An overview is provided in Table 9.

Table 9 Recurrence of predominant hazards

Hazards	**Zone A Primary**	**Zone B Secondary**	**Zone C Finishing**	**Zone D Storage**	**Zone E Office**	**Zone F Disposal**
Oils and fuels	✔✔✔		✔	✔		✔
Bilge and ballast water	✔✔			✔		✔
Paint and coatings	✔✔	✔	✔✔✔			✔
Asbestos	✔✔✔	✔	✔✔✔	✔✔✔		✔
PCB's	✔✔		✔			
Other hazardous wastes *- Anodes* *- Radiation sources* *- TBT* *- Batteries* *- Freon*	✔✔		✔	✔		✔
The number of checkmarks (✔) is an indication of the degree of importance						

In the following paragraphs and tables, measures to prevent or reduce identified hazards are outlined.

Oils and fuels

Oils and fuels				
Environmental Hazards	Preventive measures		Type P: physical O: operational	Cost level 1: low 3: high
Oil and fuel spills	• Adequate containment and pumping equipment • Adequate oil-transfer facilities • Adequate storage/disposal facilities • Oil spill cleanup and notification procedures • Oil spill containment boom • Oil spill cleanup equipment		P P P O P P	3 2 3 1 2 3
Safety hazard	Preventive measures		Type P: physical O: operational	Cost level 1: low 3: high
Risk of explosion	• Physical identification of location onboard • Cleaning oil tanks/compartments before hot work commences • Ventilate compartments/tanks continuously • Introduce a Hot-Works Certification system • Test compartment for presence of flammable vapours before issuing certificate • Isolate area and put up No Smoking signs • Keep fire extinguishing equipment immediately available		O O O O O O O	1 1 1 1 1 1 1
Health hazard	Level of control	Preventive measures	Type P: physical O: operational	Cost level 1: low 3: high
Vapours	Source	• Minimise use of manual labour at the source in the tanks for removal operations (use of pumps) • Use solvents to dissolve heavyweight sludge so that most oil and sludge can be pumped out	P O	2 1
	Compartmentalisation	• Ventilate compartments continuously • Test compartment for oxygen and presence of toxics, corrosives, irritants prior to manual cleaning	O O	1 1
	PPE	• use respiratory equipment	O	1

Bilge and ballast water

<table>
<tr><th colspan="5">Bilge and Ballast Water</th></tr>
<tr><td>Environmental Hazards</td><td colspan="2">Preventive measures</td><td>Type
P: physical
O: operational</td><td>Cost level
1: low
3: high</td></tr>
<tr><td>Bilge and ballast water spills</td><td colspan="2">• Determine pollutant concentrations prior to removal of the water
• Adequate containment and pumping equipment
• Adequate transfer operations facilities
• Adequate storage/treatment facilities
• Spill cleanup and notification procedures
• Spill containment boom
• Spill cleanup equipment
• Change of ballast water</td><td>O
P
P
P
O
P
P</td><td>1
3
2
3
1
2
2</td></tr>
<tr><td>Safety hazard</td><td colspan="2">Preventive measures</td><td>Type
P: physical
O: operational</td><td>Cost level
1: low
3: high</td></tr>
<tr><td>Risk of explosion</td><td colspan="2">• Physical identification of location onboard
• Cleaning oil tanks/compartments before hot works commence
• Ventilate compartments/tanks continuously
• Introduce a Hot-Works Certification system
• Test compartment for presence of flammable vapours before issuing certificate
• Isolate area and put up No Smoking signs
Keep fire-extinguishing equipment immediately available</td><td>O
P/O
O
O
O
O
P</td><td>1
2
1
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1
1
1</td></tr>
<tr><td>Health hazard</td><td>Level of control</td><td>Preventive measures</td><td>Type
P: physical
O: operational</td><td>Cost level
1: low
3: high</td></tr>
<tr><td rowspan="3">Vapours</td><td>Source</td><td>• Minimise use of manual labour at the source in the tanks for removal operations (use of pumps)
• Use solvents to dissolve heavyweight sludge so that most residues can be pumped out</td><td>P
P</td><td>2
1</td></tr>
<tr><td>Compartmentalisation</td><td>• Ventilate compartments continuously
• Test compartment for oxygen and presence of toxics, corrosives, irritants prior to manual cleaning</td><td>P/O
O</td><td>1
1</td></tr>
<tr><td>PPE</td><td>• use respiratory equipment</td><td>O</td><td>1</td></tr>
</table>

Paints and coatings

Paints and coatings				
Environmental Hazards	Preventive measures		Type P: physical O: operational	Cost level 1: low 3: high
Release of paint residue to the environment	• Create a separate area for paint-removal operations, with impermeable floor • Collect and contain all solid wastes resulting from paint-removal process • Provide adequate storage/disposal facilities • Provide adequate storm water discharge facilities, to avoid contamination of storm water runoff		P O P P	3 1 3 2
Safety hazard	Preventive measures		Type P: physical O: operational	Cost level 1: low 3: high
Risk of explosion	• Determine flammability of the paint • Remove all flammable paint from area to be cut prior to metal cutting to prevent ignition • If using flammable liquids for chemical stripping, provide ventilation so that concentration of vapours is below 10% of lower explosive limit • Keep fire-extinguishing equipment within instant access		O O O O	1 1 1 2
Health hazard	Level of control	Preventive measures	Type P: physical O: operational	Cost level 1: low 3: high
Vapours and burns (for chemical stripping)	Source	• Determine if paint is toxic • If paint is toxic, remove all toxic paint from area to be cut prior to metal cutting • Isolate area and create as much ventilation as possible	O O O	1 1 1
	Compartmentalisa-tion	• In working yard (zone C) create a separate area for paint-removal operations • Create as much ventilation as possible	P O	3 1
	PPE	• For chemical paint and preservative removers, protect skin, eyes and face • For toxic solvents, wear approved respiratory equipment and protect skin, eyes and face	O O	2 2

Emissions of dust and particulate matter (abrasive blasting and mechanical removal)	Source	• Create an enclosed chamber with point extraction to avoid dispersion to air. To be integrated with air filtration system. • Limit access to the area • Install vacuum system to filter air	P/O O P/O	2 1 3
	Compartmentalisa-tion	• In zone C create a separate area for paint removal operations, with impermeable floor • Create a dedicated area in zone D for storage of paint/coatings residue • Cover the area to avoid dispersion of air emission	P P	3 3
	PPE	• Wear hoods and appropriate respirators • Wear goggles or face shields	O O	2 2

Asbestos

Asbestos				
Health hazard	Level of control	Preventive measures	Type P: physical O: operational	Cost level 1: low 3: high
Inhalation of asbestos fibres	Source	• Physical identification of asbestos location onboard • Create an enclosed chamber in the ship where asbestos has been identified to avoid dispersion of air emission of asbestos • Create a limited access area • Install vacuum system to filter air • Keep asbestos wet before and during removal operations • Carefully remove as much ACM in large portions without "breaking" it • Do not try to remove ACM which is compounded in other material (e.g. flanges in pipes); Remove compounded materials entirely without disturbing ACM, and transport to asbestos area in Zone C, for removal in a dedicated asbestos-handling environment. • Package asbestos in approved packaging system • Minimise the amount of workers exposed to the asbestos containing area • Define clear asbestos-area access regulations • Decontaminate (shower) workers and change set of clothes when leaving regulated area	O P/O O P/O O O O O O O O	1 2 1 3 1 1 1 2 1 1 2
	Compart-mentalisation	• In working yard (zone C) create a separate area for paint removal operations, with impermeable floor • Cover the area to avoid air emission • Collect and contain all solid wastes resulting from asbestos removal process • Provide adequate storage and disposal facilities • Provide adequate storm water discharge facilities, to avoid dispersion of asbestos in storm water runoff	P P O P P	3 3 2 3 2

	PPE	• Provide respirators approved for protection against airborne asbestos • Wear a separate set of washable clothing • Employ specially designated asbestos workers and supervisors and ensure that employees comply to regulations regarding work with asbestos • Wear head covering, gloves, foot covering and face shield/ goggles	O O O O	2 1 1 1

PCB's

PCB's			
Environmental Hazards	Preventive measures	Type P: physical O: operational	Cost level 1: low 3: high
Release of PCB's to the environment	• Identify and label suspect materials and equipment • Carefully remove all PCB-containing materials, and transport to dedicated area in zone C • Dispose in controlled manner	O O O	1 1 2
Formation of environmentally hazardous gases	• Carefully remove PCB-containing materials, without use of heat-inducing equipment (such as torches) • Keep fire-extinguishing equipment nearby	O O	1 2

Health hazard	Level of control	Preventive measures	Type P: physical O: operational	Cost level 1: low 3: high
Exposure to PCB's	Source	• Specially designated personnel for identification and careful removal of PCB-containing materials at source	O	1
	Compartmen-talisation	• Create a dedicated area in zone C for removal / overhauling of PCB- containing materials • Create a dedicated area in zone D for storage of PCB- containing materials • Create a dedicated disposal area in Zone F	P P P	3 3 3
	PPE	• Appropriate protective clothing and equipment	O	2

5.3 Design & Construction

The generic hazard assessment identifies a number of physical measures associated with the design characteristics of the facility. The following elaborate mainly on these.

Note that the structure of the existing ship breaking industry is particularly well suited for co-operative supporting arrangements as dismantling facilities are often located adjacent to each other.

Zone A - Primary block breaking area

Zone A is located near the waterfront. The actual dismantling process is initiated in this Zone. This involves the removal of wastes and cutting the ship into large segments.

From Table 9, conclusions can be drawn as to which hazards are relevant in the Primary block breaking area.

Oil and fuels

To prevent possible environmental hazards related to the removal of oil and fuels from the ship, Zone A should be equipped with:

- Adequate impermeable bottom protection (containment) such as concrete or asphalt
- System for pumping, draining and storage

Bilge and ballast water

Bilge water can be polluted with a wide range of hydrocarbons and chemical components. Discharging to the surrounding area can therefore create environmental problems. Bilge water should be collected and disposed of in a water treatment plant where the chemical components can be removed prior to discharge.

The wastewater treatment plant can be part of the ship-breaking yard. However this may not be required if waste reception facilities are available in the area or if the vessels has discharged and is cleaned prior to arrival at the dismantling site.

Ballast water if "dirty" should be treated as bilge water as it may contain significant quantities of oil. This applies to vessels using cargo-tanks for ballast. More generally, ballast water may contain aquatic organisms including pathogens and may consequently represent a threat to health. At present, ballast water discharge is not regulated and hence, it may be discharged to the sea provided it is not "dirty".

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 breakers. An alternative may be a reception facility (either existing or new) allowing the vessel itself to deliver bilge and ballast water prior to dismantling. Such waste reception facilities may also accommodate for other wastes categories.

Paints and coatings

Paints and coatings are removed (along the cutting line) prior to cutting in order to prevent emissions to air (and for safety reasons). Environmental problems related to the removal of paints and coatings involve operational measures, (see section 5.4).

Tributyl tin (TBT) is addressed elsewhere in these guidelines (see chapter 4.2). The serious environmental impacts of TBT are well documented, and consequently, any leakage to the environment should be avoided. This can be handled efficiently (by operational procedures) at facilities separating the hull from the beach during dismantling. At beach dismantling facilities, TBT will be deposited in sediments and carried away with the current and thereby causing a threat to the marine environment. Since the application of TBT is expected to be banned by the year 2008, the TBT problem will probably be eliminated within the next decade.

Asbestos

Release of asbestos to the environment involve operational measures, (see section 5.4).

PCB's

As for the physical measures that can be implemented to remove PCBs, a distinction has to be made between solid and liquid forms.

Physical measures are irrelevant when solid forms of PCB is removed, as it does not represent an immediate hazard. However, safe area suitable for storage must be provided.

As for liquid forms of PCB, physical measures can play an important role in preserving the surrounding environment. To prevent possible environmental hazards related to the removal of liquid forms of PCBs from ships, Zone A of the ship-breaking yard should be equipped with adequate impermeable bottom protection such as concrete or asphalt.

Other hazardous wastes

As for the other hazardous wastes that are mentioned in Table 9, containment and impermeable floors are essential.

Zone B - Secondary block breaking

Zone B is the secondary block breaking area. In this area the large segments which are cut off the ship in Zone A are cut into smaller pieces which are easier to handle/transport. Not all parts removed from the ship have to enter this area for further treatment. Most of the removable parts or waste streams will be directly transported from Zone A be to Zone C or D.

As shown in Table 9, within Zone B only two hazards are relevant: paints/ coatings and asbestos.

For both hazards the remains/ debris after their removal in Zone A can cause environmental problems.

Paints and coatings

Removal of paints and coatings prior to the cutting of steel plates generates particles that can contaminate the ground and eventually the groundwater. This means that these activities should be carried out on a concrete or asphalt floor. In cases where this type of containment is difficult, a floating structure alongside the ship or even steel-plating could be used as alternative methods for containment of polluting substances. Furthermore, rainfall can also cause these particles to be flushed away and also contaminate the ground. To prevent this, the work should be carried out on an impermeable floor equipped with a rainwater collection system to discharge the contaminated water to a treatment plant.

Asbestos

For dismantling operation of asbestos-containing ship-structures, the following apply:

- Operations to take place in an enclosed limited access area accessible to authorised personnel only.
- Personnel authorised for limited access area must be trained in handling asbestos and properly equipped to handle asbestos.

- Limited access area for asbestos handling must be located away from other activities in order to shelter these from possible contamination/ spread of asbestos. Asbestos removal facilities must also be constructed in a way that prevents any spread of asbestos; with concrete/ asphalt flooring, cover (side walls/ roof), wetting system, safe storage facilities for asbestos waste, and packaging facility (bagging asbestos). (Reference should be made to ILO's Code of Practice "Safety in the use of asbestos", see also Appendix C)

  An option that will limit potential spread of asbestos even further may be that of using a sealed building with a vacuum system to filter the air. This would minimise the risks of asbestos spreading to the surroundings, but may not be feasible for many facilities.

Zone C - Finishing, sorting and overhauling

In this Zone a variety of activities are carried out in order to clean, prepare, segregate and overhaul materials and/or equipment in order to be sold or distributed.

Due to these activities the remains of several waste streams in all kind of materials (for example engines, pipes, valves, etc) can contaminate the area. Protective measures must therefore be taken (containment by concrete/ asphalt).

As for the hazards 'paint and coatings' and 'asbestos' the same preventative measure as mentioned for Zone B should be taken.

The same applies to 'oil and fuels' and 'other hazards', which may only occur in Zone C rather than Zone B. Protection of the ground by the use of an impermeable floor and/or roofs are sufficient measures.

Zone D - Storage

Materials arriving from the other dismantling zones are collected in this zone for temporary storage prior to sales and/ or further treatment.

The area must be divided into separate sectors for different types of waste materials. The entire area should be equipped with an impermeable floor (concrete/ asphalt). The area dedicated for storage of liquid waste should especially be stored under a roof, and the impermeable floor should have continuous curbing for containment.

Hazardous wastes, and especially asbestos bags, should have a dedicated indoor storage area. Further, tanks should be available for hazardous liquids.

Zone E - Office buildings and emergency facilities

No special design criteria are given to this zone because its activities do not influence the environment.

Zone F - Waste disposal facilities (e.g. incinerator, landfill)

Within Zone F the final disposal facilities will be situated, for example a landfill, wastewater treatment plant and/or an incinerator. Obviously not every dismantling-yard will be equipped with such facilities, for instance, when there are other disposal facilities nearby which can be used.

When a breaking-yard decides to have its own disposal facilities, certain design criteria then have to be taken into account. Those criteria aim to minimise the negative effect on the surrounding environment.

In the case of a landfill, protective measures have to be taken to preserve the ground. The landfill must therefore be equipped with impermeable bottom-liners, drainage-water discharge, and if organic materials are also to be disposed of, attention has to be paid to landfill gas-extraction. Seepage water from the landfill should be cleaned before discharge. The landfill location should be a permanent destination as landfill and should not be used for other purposes.

Where an incinerator is used, the minimisation of emissions to air is important. Therefore an air-cleaning system should be installed.

5.4 Operation

This section focuses on the practical aspects of operation. For each Zone, recommendations are provided focusing on the possible environmental, health and safety problems.

Zone A: primary block breaking area

In the primary block breaking area prior to the dismantling of the ship, several waste streams have to be removed such as oils and fuels, bilge and ballast water, asbestos and a variety of electronic equipment and materials.

Once those waste streams and materials are removed, the cutting of the ship into large segments can commence.

Oil and fuels

All oils and fuels have to be removed prior to dismantling operations in order to prevent contamination of ground and water due to spills when the ship is cut into large segments.

The oils and fuels have to be collected in tanks/ containers before being transported to Zone D or F.

When used oil-drums are utilised it should be checked whether these are suitable for collection and storage of oils and fuel.

Bilge and ballast water

Contaminants following bilge and ballast water treatment or residues from the vessels bilge and ballast water tank areas must be removed, containerised and transported to zone D or F.

Asbestos

Particular attention must be paid to health and safety. During operations, only authorised personnel should be allowed onboard the ship. The areas where asbestos is to be removed should be closed to avoid the spread asbestos fibres to surrounding areas. Asbestos must be kept wet before and during removal. To secure this, the work has to be carried out by two people: one who makes sure the asbestos is wet during the removal and one performing the actual asbestos removal work. It should be carefully removed without breaking and put into seal-able bags. The sealed bags can then be transported to the dedicated sector in Zone D.

Asbestos compounded in other materials should not be removed within the ship, but together with those materials that are transported to Zone C where the asbestos can be extracted and packed and sealed in the dedicated sector. When asbestos is extracted from these materials, and there is a risk that asbestos fibres will enter (due to the ongoing physical work) the air, these materials (including compounding asbestos) should be directly disposed of to Zone F.

Before works on the ship commences, warning signs should be placed indicating that the removal of asbestos is taking place. Once a ship section/ area is free of asbestos this should also be indicated.

During the removal of asbestos as few people as possible should be in the area. Those involved in the operation should be equipped with PPE according local or national rules or guidelines.

Other equipment and materials

The removal of electronic equipment and materials should be done carefully, to avoid damage and thereby a risk of compounds (PCB, mercury, radioactive material, etc.) entering the environment.

After removal, all equipment and materials should be transported directly to specific storage in Zone D or if necessary, to Zone C where further work (finishing, sorting, overhauling, etc) has to be carried out to prepare the materials for disposal or re-selling.

Paint and coatings

Paint and coatings in the cutting line must be removed prior to cutting. This can be done mechanically, chemically or by abrasive blasting. It is necessary to adopt particular measures to ensure that residues following the removal operation does not enter into the environment e.g. chemical-/ abrasive blasting residues must be collected as well as removed paint-chips. The collected residues are then transported to Zone F for final disposal.

For health reasons, proper ventilation should be ensured at all times. The work should be undertaken by staff designated and trained for paint removal and plate cutting operations. The use of special respiratory equipment is advised.

Fire fighting equipment must be accessible prior to any cutting operations.

Zone B: secondary block breaking area

In the secondary block breaking area large structures from the ship will be further cut into smaller pieces which can be more easily transported. Following cutting activities, an initial sorting process will/ can take place.

Due to preparations (removal of paint and coatings) of large ship structures prior to cutting, paint and coatings can contaminate the area. This means that in this Zone (as well as in Zone A) all removed paint and coatings should be collected and transported to Zone F, for final disposal.

Zone C: finishing, sorting and overhauling area

In the finishing, sorting and overhauling area, all collected materials are prepared for re-use/ re-sale.

Due to the nature of these activities, several hazards may occur; oil and fuel spills, spills of PCB and asbestos. As described in paragraph 5.3, these activities must take place on an impermeable floor.

Asbestos removal should take place in an enclosed area dedicated for asbestos handling, preferably indoors. Only staff who are properly trained and equipped for asbestos work should have access to this area. Adequate PPE should be provided to the staff. The asbestos must be carefully removed and placed in sealed bags before disposal in Zone F.

All liquid substances (oil, fuels, etc) should be collected, containerised (not mixed!) and transported to either Zone D, when reuse is possible, or Zone F, when disposal is necessary.

Zone D: storage areas

All materials and waste streams should be stored separately in the storage areas.

In this area special attention need to be given to the storage of asbestos or asbestos-compounded materials. Staff working with asbestos storage should be equipped with proper PPE, according to local or national rules or guidelines.

Zone E: office buildings and emergency facilities

Operational guidelines do not apply to this zone where issues on environment, health and safety in relation to the ship-breaking activities are concerned.

Zone F: waste disposal facilities

Materials for disposal extracted in any other zone must be transported to this zone for disposal. It follows that the burning of waste in other zones (which is at present common) is not allowed. Uncontrolled burning of waste causes both air and ground pollution.

The disposal of waste streams in a landfill should be carried out with great care to avoid damage to the containerised materials. Damaged containers, bags or other packaging could lead to spills and consequently to contamination of the environment.

6. ACHIEVING ENVIRONMENTALLY SOUND MANAGEMENT ESM PRACTICES

6.1 Differing techniques and methodologies (feasibility)

Paragraph 5.2 provides as an initial reference to techniques and methodologies which could be implemented to achieve ESM, accompanied by an indication of the associated level of costs. It follows that a first step towards ESM can be taken at a relatively low cost as some low-cost measures carry the potential of significant environmental improvement.

The upgrading of existing dismantling facilities can be carried out in a stepwise planned manner. It may be unrealistic to implement all identified recommendations at an initial stage due to both lack of funding, as well as to the need for raising awareness and establishing necessary legal/ regulatory frameworks.

The methodologies outlined in paragraph 5.2 distinguish between physical and operational measures:

- Most operational measures are related to health and safety aspects of the workforce and involve the provision of PPE in addition to training and awareness
- Physical measures essentially concern the adopted dismantling procedures and the provisions at the facility (equipment, layout, standards, etc.)

With regards to physical measures, lacking funding may be the primary hindrance in achieving compliance to ESM. A realistic approach may therefore be that of defining an implementation plan founded in the cost-efficiency of actual measures. From this it follows that a low cost level (level 1) should be considered implemented in a short-term perspective (within 1 year). Measures with a medium cost level (level 2) should be considered implemented within 5 years. Other measures (cost level 3) should be considered implemented within 10 years (long term). It is emphasised that the dismantling facility should prioritise identified measures for implementation on a longer term basis, reflecting the recommendations above but not without addressing the consequences of non-compliance.

6.2 Building/improving Environmentally Sound Management of ship-dismantling facilities

Conditions to be met for achieving ESM

Note that the conditions to be met for achieving ESM identified here are valid both for existing facilities as well as for new facilities.

To achieve ESM of hazardous wastes in a general sense, a number of legal, institutional and technical conditions must be met. These include, among others, the following:

- a regulatory and enforcement infrastructure ensuring compliance with applicable regulations
- authorisation of sites or facilities ensuring an adequate standard of technology and pollution control to deal with hazardous wastes
- monitoring of environmental performance at sites or facilities at which hazardous wastes are handled
- enforcement capability ensuring appropriate action taken in cases where monitoring reveals non-compliant management of hazardous wastes or resulting unacceptable emissions
- training and awareness of personnel involved in the dismantling process

In order to establish the required platform for achieving ESM, a number of activities must be undertaken. Among these are:

- the identification and quantification of waste types resulting from the dismantling process
- the identification of a best practice approach to avoid or minimise the generation of hazardous wastes

Planning for Environmentally Sound Management

There are several factors that will affect the way the facility should manage its environmental challenges. Such factors include the natural environment in which the facility is located, the society, the customers, and the governing authorities. It is recommended that the facility develops and implements an Environmental Management System (EMS) as a tool for obtaining ESM.

The successful establishment of ESM for a ship-dismantling facility requires the establishment of an Environmental Management Plan (EMP). This includes the initial step of assessing the potential environmental impacts from the facility by performing an Environmental Impact Assessment (EIA). The EIA helps to identify the environmental aspects and the environmental goals to be set for the facility, and serves as an input to the EMS. This may be illustrated in the figure below:

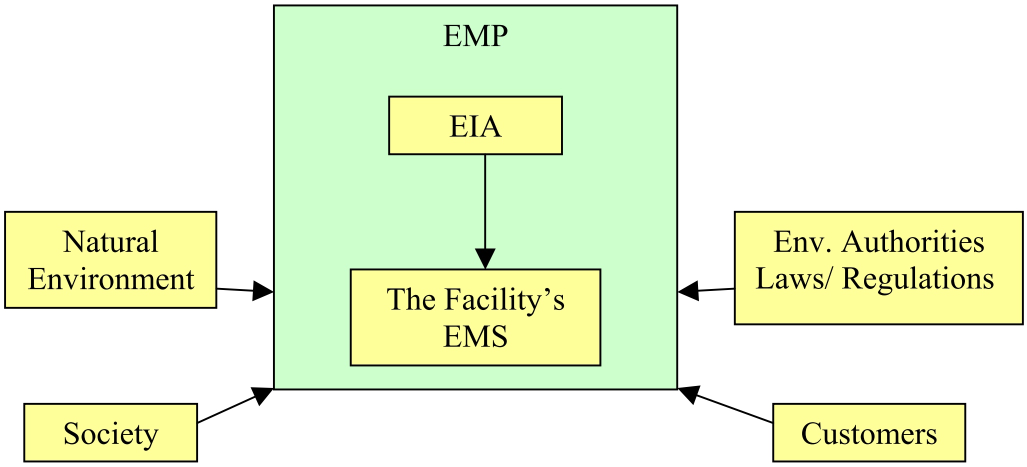


Figure 7 Factors influencing the Environmental Management System

It should be noted that individual dismantling facilities located in the same region and subjected to the same legislative or regulative framework may join forces and develop a common EMP. Individual facilities may adopt the commonly-adopted EMP and address facility-specific items in an additional or bridging document. An EMS can therefore exist at two different levels (area EMS and specific EMS).

The EMP would be an all-encompassing document covering all environmental issues at a macro-scale:

- the assessment of potential impacts (EIA)
- the formulation of potential preventative measures (Inventory of Best Practices)
- roles and responsibilities of the various parties involved in the ship-dismantling process (included in the EMS)

The environmental authorities (see Figure 7) will be responsible for:

1) A monitoring programme for the surroundings/ the recipient
2) Enforcement of requirements for the facility
3) Information (e.g. Best Practices, guidelines, measures)

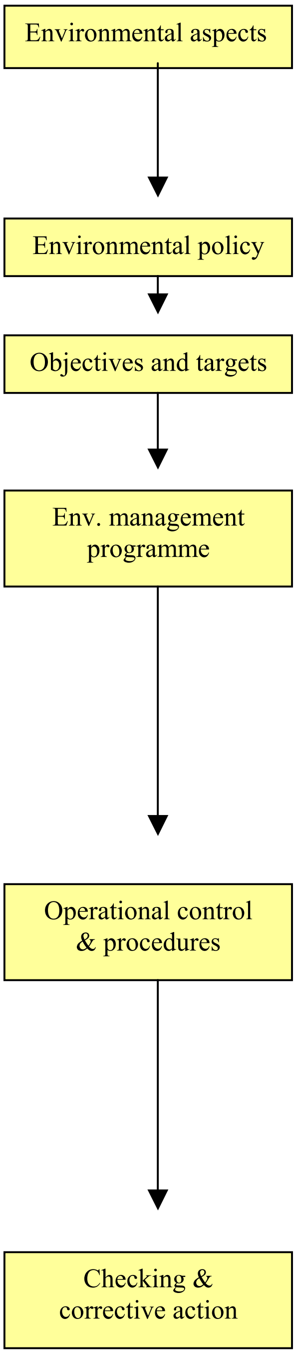
EIA (Environmental Impact Assessment) of the dismantling facility

An assessment of potential impacts (EIA) should be carried out to provide as a basis for the identification and prioritisation of the facilities environmental aspects. The EIA must take into account the local legislation. The outcome of such an EIA should include, amongst others, a description of preventative measures to be undertaken to counteract negative impacts on the environment. The EIA should be executed in a planning stage and should be initiated as early as possible. If the actual project involve a site already occupied by either ship dismantling activities or similar industrial activities, the EIA must include an assessment of the environmental condition of the location.

EMS (Environmental Management System)

In order to both achieve and to demonstrate environmentally sound performance, the ESM-compliant ship-dismantling facility would be conducted with a structured environmental management system. The international environmental standard, ISO 14001, specifies requirements of such an environmental management plan[2] and is intended to assist an organization in achieving its environmental goals. The standard is developed to accommodate diverse geographical, cultural and social conditions and does not make any legal obligations, as these will vary from one nation to another. There are no absolute requirements for environmental performance beyond commitment to compliance with applicable legislation and regulations and to continually work systematically for further improvements. Some of the main issues in the process of establishing an EMS are discussed below:

[2] The ISO 14001 standard facilitates for the development of an environmental management tool. The notations used in these guidelines describing the conceptual environmental management plan do not necessarily comply with those used in the standard.



Environmental aspects of the activities carried out at the ship-dismantling facility should be identified and prioritised based on their impacts on the environment, legal and other requirements and the views of interested parties. This information must be kept up-to-date and should be reflected in the facility's environmental policy.

The environmental policy should include a commitment to continual improvement and prevention of pollution.

The facility's environmental policy and subsequently the environmental objectives and targets set should be established and maintained for each relevant function and level in the organization.

An environmental management programme should be established and maintained. This programme should include the responsibility, means and time-frame for achieving the objectives and targets at the relevant functions and levels.

Personnel carrying out tasks that may have an impact upon the environment, must have sufficient education, training and/ or experience and must be aware of their roles and responsibilities in conforming to the environmental policy and requirements of the environmental management system (including emergency preparedness and response).

All operations and activities associated with environmental aspects must be identified. Procedures that cover situations that could lead to deviations from the environmental policy must be established and maintained.

The facility must have procedures for emergency preparedness and response, which more specifically means identifying the likelihood of and planning for response to accidents and emergency situations. Prevention and mitigation of environmental impacts following accidents and emergency situations should also be included.

Monitoring and measurements are carried out in order to record actual environmental performance and conformance with the objectives and targets laid out in the environmental policy as well as compliance with relevant environmental regulations. The ship-dismantling facility must keep records of the monitoring results, any change in the procedures resulting from corrective or preventative action, training, and results from environmental audits and reviews. Audits of the EMS should be carried out on a regular basis.

It is important to mention that an EMS also makes demands on the environmental performance of the companies that transport, handle and/or dispose of wastes originating from the ship dismantling facility.

A waste management plan, a contingency preparedness plan and the monitoring plan are all procedures that will be part of the step called 'operational control & procedures' in the facility's EMS:

WMP (Waste Management Plan);

The management of waste is the planned and controlled extraction, sorting and transport of the waste stream derived from the dismantling process. The hierarchy of approaches in waste management in its simplest form can be described as follows:

- Prevention: the first priority in waste management should be to prevent waste generation. This should be a major priority
- Recycling: the non-hazardous waste that is produced after implementing prevention measures should be re-used or recycled as far as possible
- Disposal: if prevention and recycling are not possible the waste should be disposed of in a controlled manner, and in accordance with international law

The waste management procedures will be a part of the EMS.

CPP (Contingency Preparedness Plan);

Contingency preparedness also includes health and safety issues. The objectives of the CPP have been addressed somewhat more broadly under item 4.5.

MP (Monitoring plan);

This is the identified sampling and environmental monitoring procedures to be undertaken to confirm the effectiveness of preventative measures and will function as a warning system in the case of unwanted impacts and situations.

6.3 Reporting (to the authorities) and verification

Although these guidelines do not have any legal status, some form of enforcement and a certain level of reporting are required in order to confirm compliance. The actual authority to whom reporting should be made or inspections should be carried out by, will depend upon existing national regulations for the specific country in question. Such authorities may be found at local, regional or national level.

In general, the relevant authorities must assure compliance with applicable laws and regulations. Table 10 (below) list recommendations for other issues that should be verified. The recommendations may be specific to the ship being dismantled, the facility, or to the waste handling.

Table 10 Verification for achievement of ESM at a ship-dismantling yard

Category	Recommendations
Ship-specific	Relevant authority may issue permission to start dismantling if: • the ship's inventory list (see chapter 4.1) is approved thorough inspection of the ship • all hazardous materials are marked • the ship is inspected and declared safe for hot work • non-breathable spaces are marked • a dismantling plan is prepared and approved
The facility	• the facility is approved to be in compliance with these guidelines • personnel involved in dismantling processes are trained and aware of HSE (health, safety and environmental) hazards • adequate emergency response procedures must be in place
Waste handling	• procedures for handling of hazardous wastes and other wastes must be approved • enforcement structure that takes action in cases where hazardous waste management is non-compliant or has resulted in unacceptable emissions

Responsibilities associated with the recommendations in this table may involve international agencies, national/ regional and/or local authorities, as well as the industries themselves (shipping and dismantling industries).

In accordance with its environmental management system the facility should keep records of the aspects listed below. These records should be reported periodically to the relevant authorities:

- Accidents that could lead to the release of hazardous materials to water or ground, or environmentally hazardous emissions to air
- Unintentional spills
- Monitoring results
- Handling of hazardous wastes and other wastes, including type, composition, quantity and name of approved waste-reception facility or method of possible waste disposal on site. This inventory should be based on export from zones D and F (see chapter 5.1), which represent the material flows out of the yard or wastes that are disposed of on site. Means of quantifying/measuring should be available for determining the exported amounts of the various materials.

Typical waste-type categories for sorting and reporting of wastes could be:

- Metals: ferrous and non-ferrous (subgroups for different metal qualities), with/without coating
- Oils and fuels, oily wastes from cleaning operations
- Bilge water
- Ballast water
- Waste from paint-removal processes
- Asbestos-containing materials
- PCB-containing materials
- Other waste streams

7. GAP ANALYSIS AND RECOMMENDATIONS

7.1 The gap

Chapter 3.4, 'Existing practices and standards', provides a generic starting-point for a process aiming to improve the environmental performance of ship dismantling and recycling. In chapter 4, crucial environmental aspects are identified. These serve as input to actual recommendations, which have been discussed in chapter 5, leading to generic requirements characterised as physical measures and operational measures.

The management infrastructure required for establishing an ESM-compliant dismantling facility has been addressed in chapter 6.

Existing practices and standards compared to requirements represented by recommendations provided in chapter 5 and chapter 6 reveal considerable gaps. The nature of these gaps may be characterised by insufficiencies associated to:

- awareness and understanding of environmental (health/ safety) impacts
- management practices
- equipment and the nature of methods adopted reflecting the features of the facilities themselves

The following presents recommendations for closing identified gaps and represents a generic approach. The approach should be translated into a plan, an ESM-compliance plan, particular for an actual case being that of:

- improving an existing facility to reach compliance to these recommendations
- establishing a new ESM-compliant ship dismantling facility

Such plan may make provisions for co-operative arrangements. This would be particularly relevant at dismantling centres where several independent dismantling facilities are situated adjacent to each other and where circumstances may favour mutual arrangements including equipment, reception facilities, management systems, training, etc.

7.2 Planning compliance

For the establishment of new dismantling facilities, the process of closing gaps becomes irrelevant. For new facilities, these guidelines require instant and full compliance to ESM and hence compliance to the recommendations of these guidelines.

The planning of a new ship dismantling facility should incorporate the process of achieving EMS-practices in accordance with chapter 6 and should make reference to recommendations of both operational and physical nature as contained in chapter 5. The facilities incorporated in the conceptual model ship-breaking yard should form the basis for the functional specification.

For existing ship dismantling facilities, a time schedule for developing from non-compliance to compliance should be established. Non-compliant facilities should be phased out in a time perspective of 10 years following the adoption of these guidelines. From this, it follows that any existing ship dismantling facility should prepare and implement plans for ESM-compliance in accordance with these guidelines.

Table 11 on page 92 presents some important milestones of the process of adopting the principles of ESM and to achieve compliance to the objectives of the guidelines. The table may provide as an illustrative checklist for the planning process and hence a direct input to the ESM-compliance plan, whether referring to an existing facility or to the establishment of a new. In the latter case, the implementation time frame does not apply.

Principles for scheduling the implementation

The process of moving to ESM-compliance requires measures at many different levels. Some of these may be only linked to the issue of funding sources for necessary investments, whilst others are related to competence, awareness and social issues.

Table 11 proposes a scheduled implementation process based on both the principles of cost efficiency, as well as the nature of the measures (chapter 5). Some measures are in principal "one-off" activities requiring a certain level of initial investment whilst others require not just the actual implementation but continuos enforcement. Consequently, it is important to include all aspects of ESM when planning compliance including the management requirements identified in chapter 6.

The gaps to be closed should be categorised reflecting:

- Initial measures; simple measures requiring limited funding
- Intermediate measures; measures of a certain complexity requiring investment as well as training
- The establishment of the model facility, full ESM-compliance
- Management procedures ensuring necessary maintenance and improvements at all levels

Table 11 shows a suggested path for upgrading of existing ship recycling facilities. New facilities are expected to meet all guidelines immediately (see chapter 5). The Table is not intended to be an exhaustive list of all necessary modifications. Similarly, the suggested time frames are established for general consideration. Some measures should be implemented immediately while others may require more time to implement as compared to what has been laid down in Table 11. All efforts should be made to upgrade the facilities as soon as practicable. Full upgrading should be carried out at the latest within 10 years. Occupational health and safety standards established by the International Labour Organization for worker protection, if not currently met, should be implemented immediately (see Appendix C).

Table 11 Generic checklist for closing the gaps – achieving ESM-compliance

	Implementation of actions			
	Immediately – at the latest within one year	Within one to five years	Within 5 to 10 years at the latest	
Existing practice and standards	Physical identification and labelling of hazardous materials on board	Adequate transfer operations facilities	Impermeable floors wherever hazardous materials and wastes are handled	ESM-compliant model ship-breaking yard
	Cleaning of oil tanks/compartments before hot work commences	Spill containment boom	Adequate draining and pumping equipment	
	Use solvents to dissolve heavyweight sludge so that most oil and sludge can be pumped out	Minimise use of manual labour inside the tanks for removal operations (use of pumps)	Provide adequate treatment/ disposal facilities for the different hazardous materials	
	Ventilate compartments/tanks continuously	Provide adequate storm water discharge facilities, to avoid contamination of storm water runoff	Spill cleanup equipment	
	Introduce a hot work certification system	Create an enclosed chamber in the ship where asbestos has been identified. Limit access. Filter air emissions.	Create a separate area for paint removal operations, with impermeable floor. Cover and install air filtration.	
	Test compartments for presence of flammable vapours before hot work	Create dedicated area for asbestos removal. Limit access.	Create a dedicated area for segregation of hazardous materials (e.g. PCBs).	
	Provide adequate storage facilities for hazardous wastes	Collect and contain all wastes resulting from asbestos removal processes. Pack asbestos in approved packaging system	Complete containment/ impermeable floors	
	Test compartments for presence of toxins, corrosives, irritants before entrance (manual cleaning)	Decontaminate workers when leaving the asbestos removal area		
	Identify and remove toxic or flammable paint prior to metal cutting			
	Collect and contain all wastes resulting from paint removal processes			
	Spill cleanup and notification procedures			
	Always wear rigid helmets, hard-toed shoes and gloves, as well as personal protective equipment for eyes, face and skin			
	Use appropriate protective equipment against respiratory hazards			
	Keep fire extinguishing equipment immediately available			
	Implement appropriate asbestos management procedures in accordance with ILO code of practice (ref. App. C)			
	Work with asbestos should be carried out by trained personnel only			
	Determine pollutant concentrations prior to removal of bilge and ballast water			
	Remove and dispose of PCB-containing material in a controlled manner (paragraph 4.2.6)			

Physical measures are shaded.
The physical and operational measures in the table above are somewhat more discussed in the chapters 4 and 5, if not specified otherwise.

7.3 ESM-compliance

Closing gaps start with the establishment of an ESM-compliance plan. This should encompass all items of these guidelines leading to a model facility. The plan should include the managerial aspects as well as those concerning actual measures (operational/ physical) and encompass an implementation time-schedule (i.e. as exemplified in table 11). It is important to note that the preparation of an ESM-compliance plan should not delay simple and practical measures that will benefit the workers.

When identifying and prioritising measures, the plan should reflect findings from the EIA talking into account any capacity increase requirements in the future. Particular care should be given the layout of the site, the division into zones, see chapter 5.1.

The plan should rest upon a policy statement in accordance with the recommendations provided in chapter 6.

Initial measures

These are in general of operational nature and can be implemented on a short-term basis, at the latest within one year.

A principal issue may be that of identifying requirements to the vessel itself prior to dismantling. Such measures may include the requirement of inventories and/ or precautionary actions including cleaning and removal of hazardous substances, marking of hazardous substances/ areas and securing of spaces (cleared for hot-work, ventilation). Any such requirements identified by the facility should refer to generally accepted standards and/ or norms. One such may be the ICS Industry Code of Practice on Ship Recycling.

Furthermore, initial measures should include tidiness or "good housekeeping" of the process, personal safety measures and training and raising awareness.

Tidiness/ Good housekeeping: This can be achieved by providing clean sufficiently sized areas, by clear marking and sign-posting within the site, and by adopting a practical layout with separate zones and areas for different work-operations.

Personal safety measures: This is related to human health and safety. Providing personnel with adequate equipment prevents the staff from being exposed to accidents and injury.

Training and raising awareness: This is especially important for workers involved in the breaking activities. They need to understand why certain measures have to be taken in order to protect the environment and human health. Once they have become aware of the necessity of certain measures, those measures will be easier to implement. Note that training and awareness raising are continuous processes that must be included in the management system of the facility.

Intermediate measures

As for the intermediate term, identified measures should be implemented at the latest within 5 years.

An objective for the intermediate term may be to have implemented all basic operational measures including managerial procedures as identified in the EMS. In addition, identified medium cost physical measures should be included.

Model facility compliance

Complete compliance to the objectives of the guidelines should be reached within a time-perspective of 10 years, representing a long-term perspective.

The long-term recommendations are aimed at standardisation/ certification of the ship dismantling facility.
Some main features of this phase of the process are:

- Complete containment/ Impermeable floors
- Removal of asbestos by high standards (vacuum decontamination unit)
- Incineration/ landfill with adequate environmental protection
- Wastewater treatment facility

The use of these guidelines in order to comply to generally accepted standards and to be certified thereafter, e.g. in accordance with ISO 14001, include the establishment of policies identifying targets and involving continuous improvement.

8. PRINCIPLE REFERENCES

The following publications are considered important references that have been used in the preparation of the guidelines or have been referred to in the text:

/1/ US EPA – Office of Enforcement and Compliance Assurance: "A Guide for Ship Scrappers – Tips for Regulatory Compliance", EPA 315-B-00-001, Summer 2000. WEB site: http://es.epa.gov/oeca/fedfac/scrap.pdf

/2/ US DoT – Maritime Administration: "Environmental Assessment of the sale of national defence reserve fleet vessels for scrapping", Report No. MA-ENV-820-96003, July 1997 (including Appendix D: Sampling and analysis, Appendix E: Survey of ships and materials, and Appendix F: The markets, cost and benefits of ship breaking/ recycling in the United States).

/3/ Environment Canada, Environmental Protection Branch, Pacific and Yukon Region: "Cleanup Standards for Ocean Disposal of Vessels" and "Cleanup Guidelines for Ocean Disposal of Vessels", February 1998. WEB sites: http://www.artificialreef.bc.ca/ARresources/cleanup_guidelines.html and http://www.artificialreef.bc.ca/ARresources/cleanup_standards.html

/4/ Joint UNEP/OCHA Environment Unit: "Guidelines for the Development of a National Environmental Contingency Plan" WEB site: http://www.reliefweb.int/ocha_ol/programs/response/unep/pdf%20files/planguide.pdf

/5/ ICS: "Industry Code of Practice on Ship Recycling", "Inventory of Potentially Hazardous Materials on Board", 2001. WEB site: http://www.marisec.org/recycling/index.htm

/6/ The Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal, WEB site: http://www.basel.int

/7/ Guidance in developing national and/or regional strategies for the environmentally sound management of hazardous wastes adopted by the second meeting of the Conference of the Parties in 1994

APPENDIX A

GLOSSARY AND ACRONYMS

DEFINITIONS

For the purposes of these Guidelines:

Recycling - The recovery and reprocessing of waste materials for use in new products.

Reuse - When a product is used again following normal use. Implies recovery and refurbishment before the product can be reused.

Decommissioning - Permanent withdrawal from service of a vessel and subsequent operations to bring it to the dismantling facility.

Demolition - The destruction or wrecking of a vessel

Wastes - Substances or objects that are disposed of or are intended for disposal or are required to be disposed of by the provisions of national law

Management - The collection, transport and disposal of hazardous wastes or other wastes, including after-care of disposal sites.

Approved site or facility - A site or facility for the disposal of hazardous wastes or other wastes which is authorised or permitted to operate for this purpose by a relevant authority of the State where the site or facility is located.

Environmentally sound management of hazardous wastes or other wastes - Taking all practicable steps to ensure that hazardous wastes or other wastes are managed in a manner that will protect human health and the environment against the adverse effects that may result from such wastes.

Disposal - Any operation which does not lead to the possibility of resources' recovery, recycling, reclamation, direct reuse or alternative uses.

ACRONYMS

ACM	Asbestos-Containing Materials
BIMCO	Baltic and International Maritime Council
CFC	Chlorofluorocarbons
CG	Correspondence Group
CPP	Contingency Preparedness Plan
DWT	deadweight tons (a measure expressed in metric tons (1,000 kg) or long tons (1,016 kg) of a ship's carrying capacity, including bunker oil, fresh water, crew and provisions.
ECSA	European Community Shipowner's Association
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EMS	Environmental Management System
ESM	Environmental Sound Management
GMB	Gujarat Maritime Board
HSE	Health, Safety and the Environment

IACS	International Association of Classification Societies
ICS	International Chamber of Shipping
ILO	International Labour Organization
IMO	International Maritime Organization
IWPSR	Industry Working Party on Ship Recycling
MARPOL	International Convention for the Prevention of Pollution from Ships
MEPC	Marine Environment Protection Committee
MP	Monitoring Plan
NGOs	Non-Governmental Organizations
OCHA	Office for the Coordination of Humanitarian Affairs (UNEP)
OECD	Organization for Economic Co-operation and Development
PAH	Polyaromatic hydrocarbons
PCB	Polychlorinated biphenyls
POPs	Persistent organic pollutants
PPE	Personal Protective Equipment
PVC	Polyvinyl chlorides
SOLAS	International Convention for the Safety of Life at Sea
TBT	Tributyl tin
UNEP	United Nations Environment Programme
VOCs	Volatile organic compounds
WMP	Waste Management Plan

APPENDIX
B

LIST OF HAZARDOUS WASTES AND SUBSTANCES UNDER THE BASEL CONVENTION THAT ARE RELEVANT TO SHIP DISMANTLING

List of hazardous wastes and substances under the Basel Convention that are on board or inherent in the ships' structure when the vessel arrives at a dismantling site

The following list (Table 12) includes wastes and substances that may be inherent in the structure of the vessel when the vessel arrives at the dismantling site as well as an indication as to where on the vessel the wastes and substances may be found. The list is based on List A in the Basel Convention which contains wastes that are characterised as hazardous under Article 1, paragraph 1 (a), of the Convention. Their designation to Annex VIII in the Basel Convention does not preclude the use of Annex III to demonstrate that a waste is not hazardous. Wastes specifically listed on List B in the Convention are excluded.

Some of the entries in List A in the Basel Convention overlap so that some wastes are present in several ship components and vice versa. All entries in List A that may possibly be present in the ship structure are therefore not included. Electrical appliances, batteries, etc. are included on the list of wastes and substances that may be inherent in the structure of the vessel.

Table 12 Wastes and substances that may be inherent in the vessel structure

Wastes	**Waste-location on the ship**
A1 Metal and metal-bearing wastes	
A1010 Metal wastes and waste consisting of alloys of any of the following:	
Antimony *	alloys with lead in lead-acid storage batteries, solder
Beryllium *	hardening agent in alloys, fuel containers, navigational systems
Cadmium *	bearings
Lead	connectors, couplings, bearings
Mercury	thermometers, bearing pressure sensors
Tellurium *	in alloys
A1020 Waste having as constituents or contaminants, excluding metal waste in massive form, any of the following:	
Antimony; antimony compounds *	fire retardation in plastics, textiles, rubber, etc.
Cadmium; cadmium compounds	batteries, anodes, bolts and nuts
Lead; lead compounds	batteries, paint coatings, cable insulation
A1030 Wastes having as constituents or contaminants any of the following:	
Arsenic; arsenic compound	Paints on the ships' structure
Mercury; mercury compounds	thermometers, light fittings, level switches
A1040 Wastes having as constituents any of the following:	
Hexavalent chromium compounds	paints (lead chromate) on the ships' structure
A1080 Waste zinc residues not included on list B, containing lead and cadmium in concentrations sufficient to exhibit Annex III characteristics	anodes (Cu, Cd, Pb, Zn)
A1160 Waste lead-acid batteries, whole or crushed	batteries: emergency, radio, fire alarm, start up, lifeboats
A1180 ** Waste electrical and electronic assemblies or scrap containing components such as accumulators and other batteries included on list A, mercury-switches, glass from cathode-ray tubes and other activated glass and PCB-capacitors, or contaminated with Annex I constituents (e.g., cadmium, mercury, lead, polychlorinated biphenyl) to an extent that they possess any of the characteristics contained in Annex III (note the related entry on list B B1110)	level switches, light tubes and fittings (capacitors), electrical cables

A2 Wastes containing principally inorganic constituents, which may contain metals and organic materials	
A2010 Glass waste from cathode-ray tubes and other activated glasses	tv and computer screens
A2050 Waste asbestos (dusts and fibres)	thermal insulation, surfacing material, sound insulation
A3 Wastes containing principally organic constituents, which may contain metals and inorganic materials	
A3020 Waste mineral oils unfit for their originally intended use	hydraulic fluids, oil sump (engine, lub. oil, gear, separator, etc.), oil tank residuals (cargo residues)
A3140 Waste non-halogenated organic solvents but excluding such wastes specified on list B	antifreeze fluids
A3180 Wastes, substances and articles containing, consisting of or contaminated with polychlorinated biphenyl (PCB), polychlorinated terphenyl (PCT), polychlorinated naphthalene (PCN) or polybrominated biphenyl (PBB), or any other polybrominated analogues of these compounds, at a concentration level of 50 mg/kg or more	capacitors in light fittings, PCB in oil residuals, gaskets, couplings, wiring (plastics inherent in the ships' structure)
A4 Wastes which may contain either inorganic or organic constituents	
A4030 Wastes from the production, formulation and use of biocides and phytopharmaceuticals, including waste pesticides and herbicides which are off-specification, outdated, or unfit for their originally intended use	paints and rust stabilizers, tin-based anti-fouling coatings on ships' bottoms
A4060 Waste oils/water, hydrocarbons/water mixtures, emulsions	sludge, chemicals in water, tank residuals, bilge water
A4070 Wastes from the production, formulation and use of inks, dyes, pigments, paints, lacquers, varnish excluding any such waste specified on list B (note the related entry on list B B4010)	paints and coatings on the ships' structure
A4080 Wastes of an explosive nature (but excluding such wastes specified on list B)	compressed gases (acetylene, propane, butane), cargo residues (cargo tanks)
A4130 Waste packages and containers containing Annex I substances in concentrations sufficient to exhibit Annex III hazard characteristics	cargo residues

Footnotes:

* If the component is present it is most likely bound in an alloy or present at a very low concentration

** The ship components are also covered by other List A entries (overlapping)

Table 13 includes wastes and substances that may be on board the vessel when the vessel arrives at the dismantling site as well as an indication as to where on the vessel the wastes and substances may be found.

Table 13 Wastes and substances that may be on board the vessel

Wastes	Product where waste may be found
A1170 Unsorted waste batteries excluding mixtures of only list B batteries. Waste batteries not specified on list B containing Annex I constituents to an extent to render them hazardous.	portable radios, torches
A3140 Waste non-halogenated organic solvents but excluding such wastes specified on list B	solvents and thinners
A3150 Waste halogenated organic solvents	solvents and thinners
A4010 Wastes from the production, preparation and use of pharmaceutical products but excluding such wastes specified on list B	miscellaneous medicines
A4030 Wastes from the production, formulation and use of biocides and phytopharmaceuticals, including waste pesticides and herbicides which are off-specification, outdated, or unfit for their originally intended use	insecticide sprays
A4070 Wastes from the production, formulation and use of inks, dyes, pigments, paints, lacquers, varnish excluding any such waste specified on list B (note the related entry on list B B4010)	paints and coatings
A4140 Waste consisting of or containing off specification or outdated chemicals corresponding to Annex I categories and exhibiting Annex III hazard characteristics	consumables

Certain waste components that are relevant to ship dismantling are not included in List A in the Basel Convention, but may be covered by other regulations. These waste components are listed in Table 14, together with an indication as to where on the vessel such wastes may be present.

Table 14 Waste components that are relevant to ship dismantling and which are not included in List A in the Basel Convention

Potentially hazardous materials not covered by List A in the Basel Convention:	Ship component
CFC (R12 - dichlorodifluoromethane, or R22 - chlorodifluoromethane)	refrigerants, styrofoam
Halons	fire fighting equipment
Radioactive material	Liquid-level indicators, smoke detectors, emergency signs
Microorganisms/ sediments	ballast water systems (incl. tanks)
Fuel oil, diesel oil, gas oil	

APPENDIX C

INFORMATION SOURCES RELEVANT TO SHIP DISMANTLING ASPECTS

ILO references:

1. The ILO Conventions and Recommendations on Occupational Safety and Health, as international instruments that are relevant to ship dismantling:

- Guarding Machinery Convention (No.119) and Recommendation (No.118), 1963
- Maximum Weight Convention (No.127) and Recommendation (No.128), 1967
- Occupational Cancer Convention (No.139) and Recommendation (No.147), 1974
- Working Environment (Air Pollution, Noise and Vibration) Convention (No.148) and Recommendation (No.156), 1977
- Occupational Safety and Health Convention (No.155) and Recommendation (No.164), 1981
- Occupational Health Services Convention (No.161) and Recommendation (No.171), 1985
- Asbestos Convention (No.162) and Recommendation (172), 1986
- Chemicals Convention (No.170) and Recommendation (177), 1990

2. ILO Codes of practices on occupational safety and health relevant to ship dismantling:

- Ambient factors in the workplace, 2001
- Guidelines on occupational safety and health management systems, 2001
- Recording and notification of occupational accidents and diseases, 1995
- Safety in the use of chemicals at work, 1993
- Technical and ethical guidelines for workers' health surveillance, 1992
- Safety in the use of asbestos, 1984
- Occupational safety and health in the iron and steel industry, 1983
- Occupational exposure to airborne substances harmful to health, 1980
- Protection of workers against noise & vibration in the working environment, 1977
- Safety and health in ship building and ship repairing, 1974

References to important information sources on chemical safety:

- the ILO InFocus Programme on Safety, Health and the Environment (SafeWork), WEB site: http://www.ilo.org/safework
- the ILO International Occupational Safety and Health Information Center (CIS), WEB site: http://www.ilo.org/cis
- IPCS International Chemical Safety Cards, WEB site: http://www.who.int/ipcs , and at CIS WEB site
- the Inter-Organization Programme for Sound Management of Chemicals (IOMC), WEB site: http://www.who.int/iomc
- the Intergovernmental Forum on Chemical Safety (IFCS), WEB site: and http://www.who.int/ifcs
- the Committee of Experts on the Transport of Dangerous Goods (TDG), WEB site: http://www.unece.org/trans/danger
- the Globally Harmonized System for the classification and labelling of chemicals(GHS), WEB sites: http://www.unece.org/trans/danger/publi/ghs/ghs.html and http://www.ilo.org/public/english/protection/safework/ghs
- the OECD, WEB site: http://www.oecd.org/ehs
- the UNEP, WEB site: http://www.unep.org
- UNEP/ FAO: The Rotterdam Convention on the Prior Informed Consent (PIC) Procedure for Certain Hazardous Chemicals and Pesticides in International Trade, WEB site: http://www.pic.int

- Stockholm Convention on Persistent Organic Pollutants (POPs), WEB site: http://www.chem.unep.ch/sc/
- London Convention 1972 (IMO), Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, WEB site: http://www.londonconvention.org

References relevant to ship dismantling:

US EPA – Office of Enforcement and Compliance Assurance: "A Guide for Ship Scrappers – Tips for Regulatory Compliance", EPA 315-B-00-001, Summer 2000
Environment Canada, Environmental Protection Branch, Pacific and Yukon Region: "Cleanup Standards for Ocean Disposal of Vessels" and "Cleanup Guidelines for Ocean Disposal of Vessels", February 1998

Joint UNEP/OCHA Environment Unit: "Guidelines for the Development of a National Environmental Contingency Plan"

ICS: "Industry Code of Practice on Ship Recycling", "Inventory of Potentially Hazardous Materials on Board", 2001

Det Norske Veritas: "Decommissioning Guidelines - The GUIDEC Approach" DNV Report No. 2000-3156 and "Third Party Environmental Verification – Ship Decommissioning (ENVER)" DNV Report No. 2000-3157

The Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal (1989) is a global international treaty on hazardous and other wastes. The Convention sets rules for controlling the transboundary movements and disposal of hazardous and other wastes.

The main goal of the Convention is to protect human health and the environment from the adverse effect which may result from the handling, transportation and disposal of hazardous and other wastes. To achieve this, the Convention pursues three objectives: to reduce transboundary movements of hazardous and other wastes to a minimum consistent with their environmentally sound management; to treat and dispose of such wastes as close as possible to their source of generation; and to minimize both their quantity and hazardousness which is defined in the Convention as taking all practicable steps to ensure that hazardous wastes or other wastes are managed in a manner which will protect human health and the environment against the adverse effects which may result from such wastes.

The Basel Convention entered into force in 1992.

The Protocol on Liability and Compensation for Damage resulting from Transboundary Movements of Hazardous Wastes and Their Disposal was adopted at the fifth meeting of the Conference of the Parties in 1999, in accordance with Article 12 of the Basel Convention.

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Sales No. E.03.III.D.22 ISBN 92-1-158620-8 ISSN 1020-8364

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