European Commission Directorate General Environment

**Ship Dismantling and Pre-cleaning of Ships**

Final report

June 2007
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Executive summary

Present legislative and enforcement environment

The Waste Shipment Regulation (WSR) is the European Union’s implementation of the Basel Convention, and it directly applies to “vessels and other floating structures”, which can only be exported for recovery if they are “properly emptied” of certain specified hazardous substances. It is undisputed that vessels do contain such substances primarily to ensure a vessel’s compliance with a number of international maritime safety regulations, but it is less straightforward to determine whether a vessel is indeed sold for further operation or exported for recycling purposes. In a number of cases in several EU member states it has proven extraordinary difficult to prove a ship owner’s intent to scrap, and therefore the applicability of the WSR.

The shipping industry was probably the first industry to deal with the challenges of internationalisation some 200 years ago. Many regulations now exist to ensure the safe transport of people and property from one corner of the world to another, the integrity of a vessel and an efficient market place for new, used and obsolete vessels. For this globalised industry it has been agreed to develop an IMO Convention as a new mandatory instrument on ship recycling. A convention is drafted presently to be ready for adoption in year 2008 or 2009 with expected entry into force at the earliest in 2013.

The International Convention for the Safe and Environmentally Sound Recycling of Ships aims at both the responsibilities of the shipping industry and of the recycling industry. The preparatory work has been challenging due to the inclusion of the land based recycling facilities, for which the regulation and enforcement is traditionally a national matter rather than an international one, and it has previously not been considered part of IMO Conventions to regulate land based activities except in ports. It is expected that a compromise will be found that as a goal ensures an “equivalent level of control” with the hazardous materials as found in the present WSR, and simultaneously ensuring a “level playing field” for both the shipping industry and the recycling industry. It is considered important to avoid certain flag states imposing a lax enforcement of the mechanisms to ensure a properly documented and compliant phase out of a vessel and some new or existing recycling states allow substandard conditions on the recycling yards, thus attracting a non compliant market.
A strong and enforceable global Convention is needed.

Volume of scrap market for ships in the EU

In case the work on a global instrument is not successful a regime can be imposed on a regional European basis. However, the challenge for enforcement of a European safe ship recycling policy is in the merchant fleet, where flags and/or owners of ships may change quickly. In this case reflagging may remove the major part of the potential scrap market from the EU.

This is less pronounced in the government owned fleets, which obviously includes the naval fleet, but may also included a number of other vessels under authorities such as Coast Guard, Meteorological Institutes, Pollution Prevention and Transport. Scrap volume of larger vessels from government fleets may comprise approximately 40,000 LDT/year over the coming 10 years. Only very few navy vessels are so large that they require the development of special recycling procedures. Several European companies have submitted their bids for the demolition of Clemenceau and it is therefore expected that the conditions for recycling of large vessels are already under development.

The scrap volume expected for government vessels is limited in the EU (approx. 40,000 LDT/year).

The potential volume of vessels to be scrapped from the merchant fleet flying an EU member state flag is much larger than for government vessels and range from 1.3 to 2.1 million LDT/year, not considering the possible back log due to high freight rates or the single hull oil tankers peak volume in year 2010 (the volume triples). The few years from 2000 till today has shown that the positive conditions of the freight market have kept many vessels trading longer than it was previously estimated. In case of a cooling of the market these vessels may rapidly enter the recycling market. Under the existing re-flagging conditions it must be expected that a considerable proportion of these vessels will be flagged to non-EU member states, before they reach their end-of-life. Without a new regime on safe ship recycling the vessels will undoubtedly be sold to the highest bidder, which will translate into the continuous use of the present unsafe scrapping procedures in Asia.

The scrap volume from merchant fleet under EU member state flags range from 1.3 to 2.1 million LDT/year assuming no net loss of end-of-life vessels due to reflagging.

Capacity of recycling

The government volume is rather limited and can be absorbed without major expansion within the existing capacity. Presently, very few merchant vessels are scrapped in the EU, and the vast majority of EU member state flagged vessels are scrapped in Asia along with rest of the world’s obsolete vessels on the beaches of India, Bangladesh and Pakistan.

No capacity constraint is expected for scrapping government vessels in the EU.
The capacity in the EU for safe recycling is insufficient for the potential phase out volume of member state flagged merchant ships. Under the present market conditions the capacity amount only to some 200,000 LDT/year and part of this already is being used now for smaller vessels and government vessels. The potential capacity for recycling is substantial in terms of physical infrastructure: quays, skilled work force, disposal facilities etc. but this will not be developed to cater for the merchant fleet unless market conditions improve. Almost the entire scrapping in Europe today is carried out as pier-breaking, where the ship is aligned to a quay or moored along the bank of a river and scrapped from the top, or with a slipway where the bow is pulled onshore and the vessel is scrapped from the front. There have been calls for the use of dry docking facilities for the entire process of dismantling. However, in many yards such requirement would limit the volume of vessels potentially recycled and may be reserved for the keel section allowing pier breaking of the hull in the EU.

Insufficient green capacity exists in the EU, but infrastructure is readily available.

Table 1  Demand for recycling and capacity in safe and environmentally sound recycling

<table>
<thead>
<tr>
<th>EU Government vessels and fishing vessels</th>
<th>LDT/year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recycling demand</td>
<td>40,000</td>
</tr>
<tr>
<td>Existing EU capacity</td>
<td>200,000</td>
</tr>
<tr>
<td>Balance</td>
<td>+160,000</td>
</tr>
<tr>
<td>Capacity need</td>
<td>No extra capacity needed</td>
</tr>
<tr>
<td>Certified facility in Turkey*</td>
<td>50,000</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>European flagged merchant fleet</th>
<th>LDT/year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recycling demand</td>
<td>1,600,000</td>
</tr>
<tr>
<td>Existing EU</td>
<td>200,000</td>
</tr>
<tr>
<td>Mobilisable in EU (existing infrastructure)</td>
<td>1,000,000</td>
</tr>
<tr>
<td>Balance</td>
<td>-400,000</td>
</tr>
<tr>
<td>Capacity need</td>
<td>Extra capacity needed</td>
</tr>
<tr>
<td>Mobilisable in Turkey*</td>
<td>600,000</td>
</tr>
<tr>
<td>Certified facilities in China*</td>
<td>1,500,000</td>
</tr>
</tbody>
</table>

* The capacity in Turkey and China is not yet fully recognised as safe and environmentally sound recycling and the facilities in China are outside of OECD.

The recycling capacity most readily available is in Aliaga, Turkey. It is estimated at 0.6-1.0 million LDT/year. Several of the companies in Aliaga have obtained international certifications on environmental and occupational health. Further, shared facilities for hazardous waste management are available at the site. It is not clear how much of the total capacity in Aliaga is certifiable at present and certain member states have expressed reservations regarding the recycling procedures in Turkey. If the basic applied coastal procedure is considered
comparable to pier breaking, and thus deemed acceptable, the improvements needed to reach safe and environmentally sound ship recycling do not appear to be insurmountable.

Up to 1 million LDT/year safe and environmentally sound recycling capacity can be generated in Turkey.

In the OECD area facilities are available in the USA although these are used to recycle the Navy and MARAD vessels with a current capacity of 225,000 LDT/year. Until now these facilities have not imported vessels. In the EFTA region several companies operate decommissioning facilities for offshore platforms in Norway and some have already recycled ships.

In Asia the current location for safer dismantling is China where several yards, which are internationally certified on environmental and occupational health, offer ship recycling with the pier breaking method. One facility in China has cooperated with an international shipping company to scrap vessels under safe conditions. The combined green recycling capacity in China is estimated to be approx. one million LDT/year.

Up to 1 million LDT/year green recycling capacity is available in China.

Yards in India have entered the recycling market to offer recycling certified according to ISO and OHSAS.

The table below includes the identified ship recycling facilities, which are certified or authorised xx procedures. The list of facilities has been split into European facilities, OECD facilities, Asian facilities and beaching facilities. Regarding the European facilities it has not been investigated if these have been certified according to relevant international standards (ISO 14001 or OHSAS 18001). These are considered by definition as compliant with Community and national legislation and therefore operating according to safe and environmentally sound management procedures.

---

1 In minutes from a recent IMO seminar in Zhu Hai, China, the China National Shipbreaking Association reports a potential annual capacity of 3,000,000 LDT in safe and environmentally sound recycling.
### Table 2 Facilities, capacities and certification

<table>
<thead>
<tr>
<th>Country</th>
<th>Facility</th>
<th>Annual capacity LDT</th>
<th>Certification/authorization</th>
<th>Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gent, Belgium</td>
<td>Van Heyghen Recycling S.A.</td>
<td>60,000</td>
<td>National authority</td>
<td>Pier breaking and slipway</td>
</tr>
<tr>
<td>s-Gravendeel, The Netherlands</td>
<td>Scheepssloperij Nederland B.V.</td>
<td>30,000</td>
<td>National authority</td>
<td>Slipway</td>
</tr>
<tr>
<td>Naples, Italy</td>
<td>Simont S.p.a</td>
<td>80,000</td>
<td>National authority</td>
<td>Pier breaking</td>
</tr>
<tr>
<td>Grenaa, Denmark</td>
<td>Fornaes ApS</td>
<td>25,000 – 30,000</td>
<td>National authority</td>
<td>Pier breaking</td>
</tr>
<tr>
<td>Gdansk, Poland</td>
<td>Gdansk shipyard.</td>
<td>Not available</td>
<td>National authority</td>
<td>Not available</td>
</tr>
<tr>
<td>Aliaga, Turkey</td>
<td>Loyal Ship Dismantling &amp; Recycling</td>
<td>100,000</td>
<td>ISO 9001, ISO 14001 and OHSAS 18001</td>
<td>Landing</td>
</tr>
<tr>
<td>Jiangyin, China</td>
<td>Jiangyin Changjiang Xiagang Ship breaking Company</td>
<td>300,000*</td>
<td>P&amp;O Nedlloyd (now Maersk) partner ISO14001 and OHSAS 18001</td>
<td>Pier breaking</td>
</tr>
<tr>
<td>Jiangmen, China</td>
<td>Zhongxin Shipbreaking Steel &amp; Iron company Ltd, Jiang Men City, Guangdong Province</td>
<td>300,000</td>
<td>ISO 14001 OHSAS 18001</td>
<td>Pier breaking</td>
</tr>
<tr>
<td>Jiangmen, China</td>
<td>Xinhui Shuangshui Shipbreaking &amp; Steel. Co. Ltd</td>
<td>60,000</td>
<td>ISO 14001 OHSAS 18001</td>
<td>Pier breaking</td>
</tr>
<tr>
<td>Jiangsu, China</td>
<td>Xin Rong Recycling &amp; Logistics Co. Ltd (formerly Jiangsu Changrong Steel Co.)</td>
<td>&gt;100,000</td>
<td>ISO 14001 OHSAS 18001</td>
<td>Pier and dock breaking</td>
</tr>
<tr>
<td>China</td>
<td>Guangzhou Panyu Ship Breaking &amp; Steel Rolling Co**</td>
<td>40,000</td>
<td>ISO 14001 OHSAS 18001</td>
<td>Pier breaking</td>
</tr>
</tbody>
</table>

It is currently discussed in IMO whether beaching can be accepted as safe and environmentally sound ship recycling. Beaching is not considered compliant with the relevant technical guidelines of the Basel Convention which require "impermeable floors wherever hazardous materials and wastes are handled". In Alang, India, 32 yards have received ISO 14001 and OHSAS 18001 certifications.

* According to info from yard under upgrade to 1,000,000 LDT/year

A number of facilities are not included in the list because their capacities are at present low or because they are not open to EU ships (US Facilities). The facilities with limited annual capacity could constitute a future capacity in case of upgrade and include:

- Klapeidosa Laivu Remontas, Kuusakoski, and Subare, all Klaipeda, Lithuania
- Liepajas Metalurgs, Liepaja, Latvia
- Kuusakoski, Riga, Latvia
- HKS Metals’s Gravendeel, The Netherlands
• Various yards in Gdańsk, Gdynia, Władysławowo, Kołobrzeg and Dziwnów, Poland
• Smedegaarden and Jatop ApS, both Denmark
• Desguaces de la Arena (Soto del Barco), Spain
• Bacopoulos and Savvas Piraeus, both Greece

Regarding the facilities certified according to relevant international standards (ISO 14001 or OHSAS 18001) it is up to the ship owner to ensure that the facilities management systems include the relevant procedures for the actual scrapping activities and down-stream waste management. Further, the performance of these facilities should be further investigated prior to delivering ships for recycling at the facilities and benchmarked against the requirements for safe and environmentally sound ship recycling.

**Are there feasible options in pre-cleaning?**

The WSR and the Basel Convention accept export of vessels not containing hazardous substances for recovery in non-EU or OECD countries. If vessels could be cleaned before export (pre-cleaned) the removal of hazardous substances would take place where the capacity already exists. The demolition process would then take place in existing yards in Asia providing jobs and steel where this is in great demand. It should however be recalled that the safety and workers' health issues must be addressed when considering the use of beaching as a recycling method. But, in theory a methodology that could “properly empty” the vessel, while still allowing it to sail under its own power, would solve the legal obstacles of exporting ships for reuse.

Presently, it is considered that only little of the materials used for safety reasons in a ship can be removed without rendering the vessel unsafe; and if substantial amounts of structurally and operationally associated materials are removed from the engine room etc. the vessel will not be able to sail under its own power. For the pre-cleaning methodology to be feasible, it may be necessary:

- to relax the requirements of the Basel Convention as implemented in WSR allowing export of vessels under specified conditions or

- to accept that methods for the complete removal of hazardous materials from the vessel will require towing to the vessel’s final destination.

The study has not examined the details of a possible amendment of the Basel Convention or the WSR to allow export of vessels. It is suggested that the use of a mechanism to establish the existence and use of appropriate dismantling and disposal technology in the recycling country should allow for acknowledgement of an “equivalent level of control”. Another option would be to require re-export of hazardous materials to the ship’s flag state or the country of ownership. Both options would allow more residual materials in a “properly emptied” vessel. The experience with pre-cleaning is still limited and primarily restricted to naval vessels and abandoned vessels. The costs of pre-cleaning derived from these experiences may not be representative for merchant ships.
The possibility of towing empty hulls has been examined. Statistically towing add to the risk associated with transport, but when considering empty hulls the extra risk is less than typically envisaged since fewer staff are involved and no cargo or bunker oil can be lost. In fact, the Suez Canal Authority has recently demanded that all vessels destined for recycling be towed in the canal to reduce the risk of accidents. Thus, towing of pre-cleaned vessels is technically feasible, but will also entail additional cost and the need for increasing the fleet of tugs.

The experience with pre-cleaning of naval vessels may not be representative to the merchant fleet.

Pre-cleaning under current legislation will entail towing to the final recycling destination.

Towing to recycling facility will add a limited risk compared to a final voyage with cargo.

Will sufficient capacity be available for government vessels and for merchant vessels?

The dismantling market expects the member states to tender dismantling of government vessels under economically sustainable conditions and the necessary capacity is therefore under development. Some actors are investigating how to establish more capacity in the event of a new international or Community legislative regime on ship recycling of merchant vessels. There appear to be no private investment in European end-of-life solutions for merchant vessels.

Table 3 Estimated costs of effects of ship dismantling in the four scenarios

<table>
<thead>
<tr>
<th>USD per LDT</th>
<th>Reference scenario, Bangladesh</th>
<th>Pre-cleaning scenario</th>
<th>Full green dismantling, EU</th>
<th>Full green dismantling, Turkey or China*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-cleaning costs</td>
<td>0</td>
<td>-200 - -100</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Towing costs from pre-cleaning to dismantling site</td>
<td>0</td>
<td>-65</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Risk of accident by towing</td>
<td>0</td>
<td>-15</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Ship end-of-life value</td>
<td>380</td>
<td>380</td>
<td>-20 - 130</td>
<td>225</td>
</tr>
<tr>
<td>Net revenue from recycling</td>
<td>380</td>
<td>100 - 200</td>
<td>-20 - 130</td>
<td>225</td>
</tr>
<tr>
<td>Difference to reference scenario</td>
<td>-</td>
<td>180 - 280</td>
<td>250 - 400</td>
<td>155</td>
</tr>
</tbody>
</table>

*China is not an OECD member and direct export to China is not compliant with the European Community Waste Shipment Regulation.

The extra costs associated with safer recycling and the low wages causes the price offered per LDT to drop from more than 400 USD/LDT in Bangladesh, India and Pakistan to 200-225 USD/LDT in China and Turkey. This corresponds to a “loss” of almost 3 million USD for a typical Panamax tanker, if a
ship owner chooses safer recycling. Tankers, bulk carriers and container ships are easier to dismantle than passenger/ro-ro ferries and non-cargo vessels and the cost difference will be more pronounced with a structurally more complex vessel.

From a strict economic perspective the most attractive alternative to beaching in Asia is dismantling at a Turkish site. Turkey is a member of OECD, is a Party to the Basel Convention and is a member of the International Maritime Organization (IMO). Economically, the second-best alternative seems to be the option with pre-cleaning in Europe and towing to dismantling in Asia although serious objections would be raised if the dangerous and hazardous working conditions embedded in the beaching method used in dismantling in Asia remained unchanged.

Today the capacity for dismantling all European owned/flagged vessels do not exist, but there are no technical constraints for establishing the capacity in the EU. However, it should be underlined that the EU scenario is far from being economically self-supporting and a scheme which ensures that there is a real incentive will have to rely on generous subsidies or a polluter pay scheme not easily enforced.

The economically most feasible alternative to the scrapping on the Indian Subcontinent is the recycling facilities in Turkey.

Pre-cleaning of vessels in member states and exporting of hulls to is technically and economically possible, but will not change unsafe working condition in breaking nations.

Ship recycling in the EU is technically possible also for large vessels, but the capacity will not be developed under the present market conditions.

What are the options for improving the recycling of European flagged vessels?

To avoid the scrapping of ships under unacceptable conditions a number of actions can be envisioned. Basically, there are three types of instruments available for handling this situation:

- Regulation. Although IMO is underway with a proposed Convention on ship recycling, the process of ratification is long and enforcement challenges must be anticipated. EU interim measures may be undertaken.

- Economic incentives. A number of incentives prompting ship owners to choose acceptable scrapping have been proposed, including a ship recycling fund.

- Information. Raising awareness among ship owners, authorities in breaker countries, workers and other stakeholders.
The established policy of the EU rests on “the polluter pays principle” in these matters. Due to the ease of sale and reflagging of the movable asset there is a limited legal obstacle and a considerable economic incentive to choose an Asian recycling yard. In addition to awareness raising in the industry, a few specific technical assistances, such as certification and labelling of yards, and utilisation of a number of existing EU programmes for industrial R&D and regional or local development, what is needed is the emergence of a market for safe and environmentally sound recycling. Public tendering of the dismantling of government vessels will assist this, but a commercial market for green recycling of merchant vessels will only appear once the cost difference between the Asian beaching facilities and the acceptable facilities is decreased. Under the current regulatory and commercial conditions in the global shipping and recycling industries this may only be effectively achieved by subsidising the activity.

Table 4 Estimated subsidy needed for ship dismantling in the three alternative scenarios until entry into force of new convention

<table>
<thead>
<tr>
<th>Pre-cleaning scenario</th>
<th>Full green dismantling, EU</th>
<th>Full green dismantling, Turkey</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost difference to reference scenario of 380 USD (USD per LDT)</td>
<td>180 - 280</td>
<td>250 – 400</td>
</tr>
<tr>
<td>Scrapping volume, all vessel types, EU flagged (LDT per year)</td>
<td>1,600,000</td>
<td></td>
</tr>
<tr>
<td>Total subsidy needed, 2007-2013</td>
<td></td>
<td></td>
</tr>
<tr>
<td>mill. USD per year</td>
<td>290-450</td>
<td>400-640</td>
</tr>
<tr>
<td>mill. EUR per year</td>
<td>214-333</td>
<td>296-473</td>
</tr>
</tbody>
</table>

Note: The calculated cost differences are associated with uncertainty and only provide the order of magnitude of the difference to the conventional beaching method.

A subsidy is not likely to remain a permanent feature. It is estimated that once a convention has entered into force at the earliest in 2013 the new global level playing field dictated by the Convention will ensure an even level of control and there will be no more need for this kind of financial support.

Existing programmes for industrial R&D, regional development and technical assistance to selected countries can be used for supporting activities to the recycling and shipping industries.

A direct financial mechanism for supporting the recycling of merchant vessels may generate the necessary market for safe and environmentally sound recycling.

The study has 16 recommendations.

Recommendations for the Convention and its implementation:

1. The IMO convention on ship recycling should include enforceable and adequate requirements and standards.
2. It is proposed that an internationally recognised classification, certification and audit system for recycling yards is created.

3. It is proposed that a mechanism for exchange and evaluation of ship recycling plans is established possibly with a third-party verification.

Particularly regarding pre-cleaning:

4. It is proposed to compile existing quantitative standards and develop a pilot case for export of an actual vessel pre-cleaned to the “properly emptied” level.

5. It is proposed to investigate the feasibility of establishing EU-based or overseas pre-cleaning facilities servicing shipbreaking in Europe/Turkey or Asian yards respectively, thus minimising towing of hulls.

6. It is proposed to develop a mechanism to establish the existence and use of appropriate dismantling and disposal technology in the final recycling country thus ensuring “equivalent level of control” to allow for export of a pre-cleaned vessel.

7. An option is to allow re-export of hazardous materials to the ship’s flag state or the country of ownership.

8. It is proposed to assess a pilot case for export of a non-pre-cleaned vessel and treatment at the receiving yard, taking into account the need for acceptable dismantling procedures and disposal facilities.

Recommendations for the interim period up to the Convention:

9. To concentrate the capacity it is suggested that tendering of obsolete vessels for scrapping is carried out at Community level. The tendering process could be performed by pre-qualifying yards and then tender out between these yards on a vessel-by-vessel basis.

10. A knowledge-sharing programme should be established involving yards, ship owners, local authorities and professional knowledge base, such as the classification societies and other consultants.

11. The Commission could consider establishing a price in tandem awarded to an upgraded yard and a responsible ship owner, who successfully scrapped a vessel under appropriate conditions.

12. A fast track project with reference to recommendation 2 may initiate the development of a European Community voluntary classification and labelling of member state facilities, open to candidate countries, OECD/EFTA and facilities elsewhere, in particular those in Asia, claiming safe and environmentally sound ship recycling.
13. It is proposed to establish a demonstration project for upgrading/certifying one or several recycling yard(s) in the EU, Turkey, China or India/Bangladesh, preferably with a demonstration vessel scrapped under full documentation and reporting.

14. It is proposed that all existing vessels under EU member state flagged ships and ships calling at EU ports after a given date, e.g. January 1st 2010, must complete Part I of the Inventory of Hazardous Materials as developed by the IMO (Parts II and III must be completed for vessels before their final journey).

15. Raising awareness may include training of EU port officials and other enforcement personnel in recognising the signs of a “to be scrapped” vessel.

16. The market will not develop a supply of green recycling facilities under the current demand conditions. Designing an efficient scheme with subsidies to ensure green dismantling of EU flagged ships must be evaluated separately.
Foreword

This study was initiated by the Directorate-General Environment of the European Commission (DG ENV) under contract No 07010401/2006/443949/MAR/G4 of September 11th 2006. The background is the current environmental, technical, legal and economic problems associated with the scrapping of vessels, notably state-owned vessels, which have been highlighted by for instance the transfer of US end-of-life vessels to the UK in 2003 and more recently the French former aircraft carrier Clemenceau attempted transfer to India. The project has been steered by DG ENV in co-ordination with experts of the European Maritime Safety Agency (EMSA).

The study was carried out by COWI A/S in association with DHI Water and Environment by a team led by Dr. F. Stuer-Lauridsen and Mr. K. Winther Ringgaard. The team comprised Mr. M. P. Jensen (Environmental Economics), Mr. T. Odgaard (Shipping Economics), Mr. D. F. Olsen (Risk Assessment) and Ms. H. Husum (Environmental Law).

A great number of representatives of industry, national and international Authorities, NGOs and other stakeholders are thanked for having contributed information to the study.

The views and opinions expressed in the study are those of the Team of experts that have conducted the study and do not necessarily represent the views and opinions of the European Commission.
### Abbreviations and Glossary

<table>
<thead>
<tr>
<th>Abbreviation/acronym</th>
<th>Name</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aframax</td>
<td>Average Freight Rate Assessment</td>
<td>Tanker between 80,000 and 120,000 DWT. AFRA is an acronym for Average Freight Rate Assessment.</td>
</tr>
<tr>
<td>Ballast</td>
<td></td>
<td>Seawater taken into a vessel's tanks in order to submerge the vessel to proper trim</td>
</tr>
<tr>
<td>BC</td>
<td>Basel Convention</td>
<td>The Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal</td>
</tr>
<tr>
<td>BIMCO</td>
<td>Baltic and International Maritime Council</td>
<td>Trade organisation representing ship owners, ship brokers and agents, and other members</td>
</tr>
<tr>
<td>Bulk Cargo</td>
<td></td>
<td>Usually a homogeneous cargo stowed in bulk, and not enclosed in any container</td>
</tr>
<tr>
<td>Capesize</td>
<td></td>
<td>Vessels too large for the Panama or Suez Canals. Tonnage typically up to 175,000 DWT.</td>
</tr>
<tr>
<td>CAS</td>
<td>Condition Assessment Scheme</td>
<td>Condition Assessment Scheme which stipulates verification of the reported structural condition of the ship and that documentary and survey procedures have been properly carried out and completed.</td>
</tr>
<tr>
<td>Category 1 tankers</td>
<td></td>
<td>Single hull crude oil tankers of 20,000 tons deadweight and above and single hull oil product carriers of 30,000 tons deadweight and above having no segregated ballast tanks in protective locations (SBT/PL). They are generally constructed before 1982.</td>
</tr>
<tr>
<td>Category 2 tankers</td>
<td></td>
<td>Same size as category 1 tankers, but equipped with (SBT/PL) and provide therefore greater protection against grounding and collision. They are generally constructed between 1982 and 1996.</td>
</tr>
<tr>
<td>Category 3 tankers</td>
<td></td>
<td>Single hull oil tankers below the size limits of categories 1 and 2 but above 5,000 tons deadweight</td>
</tr>
<tr>
<td>Deadweight, DWT</td>
<td>Dead Weight Tonnage</td>
<td>The lifting or carrying capacity of a ship when fully loaded. The deadweight is the difference, in tonnes, between the displacement and the lightweight. It includes cargo, bunkers, water (potable, boiler, ballast), stores, passengers and crew.</td>
</tr>
<tr>
<td>Decommission</td>
<td></td>
<td>The decision and process of taking a ship out of service. Often used regarding navy vessels.</td>
</tr>
<tr>
<td>Demolition</td>
<td></td>
<td>The process of taking a ship apart. Mostly used for on shore operation.</td>
</tr>
<tr>
<td>Dismantling</td>
<td></td>
<td>The process of taking a ship apart. Term preferred by the Basel Convention and used in their guideline. Also a preferred term with</td>
</tr>
<tr>
<td>Abbreviation/ acronym</td>
<td>Name</td>
<td>Explanation</td>
</tr>
<tr>
<td>-----------------------</td>
<td>-------------------------------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>EHS</td>
<td>Environment, Health and Safety</td>
<td>Procedures to address compliance to regulatory requirements in these areas</td>
</tr>
<tr>
<td>EMAS</td>
<td>Eco-Management and Audit Scheme</td>
<td>EU management tool for companies and other organisations set out in Regulation (EC) No 761/2001</td>
</tr>
<tr>
<td>EMS</td>
<td>Environmental Management Systems</td>
<td>Procedures for environmental issues</td>
</tr>
<tr>
<td>ESM</td>
<td>Environmentally Sound Management</td>
<td>Specifically referring to the BC Technical Guidelines for the Environmentally Sound Management of the Full and Partial Dismantling of Ships.</td>
</tr>
<tr>
<td>EU Member states</td>
<td>European Union member countries as of January 1 2007</td>
<td></td>
</tr>
<tr>
<td>EU candidate countries</td>
<td>Turkey, Croatia and the Former Yugoslavian Republic of Macedonia</td>
<td></td>
</tr>
<tr>
<td>DT</td>
<td>Displacement Tonnage</td>
<td>Expressed in tonnes it is the weight the water displaced by the vessel which in turn is the weight of the vessel at that time.</td>
</tr>
<tr>
<td>Gas free</td>
<td>Gas free (for hot work)</td>
<td>Gas Free Certificate - A certificate stating that the air in a tanker's (empty) cargo tanks is safe.</td>
</tr>
<tr>
<td>GT</td>
<td>Gross Tonnage</td>
<td>The internal capacity of a vessel measured in units of 100 cubic feet</td>
</tr>
<tr>
<td>Handymax</td>
<td>Handymax types are small freighters and tankers with less than 60,000 DWT.</td>
<td></td>
</tr>
<tr>
<td>ICS</td>
<td>International Chamber of Shipping</td>
<td>The international trade association for merchant ship operators</td>
</tr>
<tr>
<td>ILO</td>
<td>International Labour Organisation</td>
<td>The UN agency seeking the promotion of social justice and internationally recognized human and labour rights</td>
</tr>
<tr>
<td>ISO</td>
<td>International Organization for Standardization</td>
<td>ISO has developed the widespread environmental standard, ISO14000, often referred to as ISO 14001.</td>
</tr>
<tr>
<td>IMO</td>
<td>International Maritime Organisation</td>
<td>The United Nations' agency responsible for improving maritime safety and preventing pollution from ships</td>
</tr>
<tr>
<td>Lightweight, LDT</td>
<td>Light displacement tonnes or Lightweight</td>
<td>The lightweight is the displacement, in t, without cargo, fuel, lubricating oil, ballast water, fresh water and feed water, consumable stores and passengers and crew and their effects, but including liquids in piping.</td>
</tr>
<tr>
<td>MARAD</td>
<td>Maritime Administration</td>
<td>US Department of Transportation Authority</td>
</tr>
<tr>
<td>MARPOL</td>
<td></td>
<td>International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto (MARPOL 73/78)</td>
</tr>
<tr>
<td>MARPOL tankers</td>
<td></td>
<td>Category 2 tankers according to MARPOL 73/78</td>
</tr>
<tr>
<td>MEPC</td>
<td>Marine Environment Protection Committee</td>
<td>IMO's senior technical body on marine pollution related matters</td>
</tr>
<tr>
<td>OECD</td>
<td>Organisation for Economic Co-operation and Development</td>
<td>Includes the countries Australia, Austria, Belgium, Canada, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Korea, Luxembourg, Mexico, Netherlands, New Zealand, Norway, Poland, Portugal, Slovak Republic, Spain, Sweden, Switzerland, Turkey, United Kingdom, United States.</td>
</tr>
<tr>
<td>Abbreviation/ acronym</td>
<td>Name</td>
<td>Explanation</td>
</tr>
<tr>
<td>------------------------</td>
<td>------------------------------------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>OHSAS</td>
<td>Occupation Health and Safety Assessment Series</td>
<td>OHSAS 18000 is an Occupation Health and Safety Assessment Series. Often the reference is to the standard OHSAS 18001.</td>
</tr>
<tr>
<td>Panamax.</td>
<td>The largest acceptable size to transit the Panama Canal; applied to both freighters and tankers; lengths are restricted to a maximum of 275 meters, and widths to slightly more than 32 meter. The average size about 65,000 DWT, but size may go up to &gt;80,000 DWT.</td>
<td></td>
</tr>
<tr>
<td>Pre-MARPOL tankers</td>
<td>Category 1 tankers according to MARPOL 73/78</td>
<td></td>
</tr>
<tr>
<td>Recycling</td>
<td>The process of taking a ship apart. Term preferred by the shipping industry and IMO. When procedures to safeguard the environment, workers' health and safety are applied - &quot;green recycling&quot;.</td>
<td></td>
</tr>
<tr>
<td>SBT/PL</td>
<td>Segregated ballast tanks in protective locations</td>
<td>Ballast tanks positioned where the impact of a collision or grounding is likely to be greatest.</td>
</tr>
<tr>
<td>Scrapping</td>
<td>&quot;Neutral&quot; word for the process of taking a ship apart. Term preferred in the US EPA guideline and often used in the reused metal business.</td>
<td></td>
</tr>
<tr>
<td>Ship breaking</td>
<td>The process of taking a ship apart. The term is preferred by ILO, EU and many of the national ship breakers' associations.</td>
<td></td>
</tr>
<tr>
<td>Suezmax</td>
<td>The maximum size ship that pass through the Suez Canal in terms of width, length and draught; generally 110,000 - 150,000 DWT.</td>
<td></td>
</tr>
<tr>
<td>ULCC</td>
<td>Ultra Large Crude Carrier</td>
<td>Tanker of 320,000 DWT and above</td>
</tr>
<tr>
<td>US EPA</td>
<td>United States Environmental Protection Agency</td>
<td>United States Government Environmental Authority</td>
</tr>
<tr>
<td>VLCC</td>
<td>Very Large Crude Carrier</td>
<td>Tanker of 200,000-320,000 DWT</td>
</tr>
<tr>
<td>WEEE</td>
<td>Waste Electrical and Electronic Equipment</td>
<td>E-waste as regulated in the EU by Directive 2002/96/EC.</td>
</tr>
</tbody>
</table>
1 Introduction

1.1 Ship recycling as a global activity

Dismantling of vessels was a common part of a port scene especially throughout southern Europe from the late 1940s to the 1960s. Lower labour costs and a domestic demand for steel meant that vessels were more likely to be scrapped in Japan, Korea and Taiwan during the late 1960s, 1970s and early 1980s, but for the last 25 years, the global centre for shipbreaking has been India, Bangladesh and Pakistan. Here, the ships are scrapped directly on the beaches or what are in fact vast intertidal mudflats exposed daily by a 10 m tidal gauge. The beaching method of the Indian Subcontinent relies heavily on low labour cost since it involves very little mechanisation.

For more than 10 years shipbreaking has also been the issue of a strong public debate fuelled first by the images captured at Chittagong in Bangladesh by the Brazilian photographer Sebastiao Salgado and published in his book "Workers" from 1993. Since then, the authors of a series of articles on the conditions in Alang, “The Shipbreakers”, were awarded the Pulitzer Prize in 1997, and not least the efforts of the NGOs, in particular the Greenpeace shipbreaking campaign, have regularly brought end-of-life ships, ship owners, shipbreaking yards and various authorities in the public spotlight and questioned the legality of the present practices.

The European Commission has addressed ship scrapping in several studies since 2000, and international bodies such as the International Labour Organisation (ILO), the Basel Convention Conference of the Parties and the International Maritime Organisation have increasingly addressed the issue of shipbreaking or ship recycling with the aim of bringing a global mandatory regime to the field. Also, governments of EU member states and OECD countries have initiated actions to specifically regulate this issue.

Lately, a few responsible ship owners have become reluctant to send their vessels to the scrapping beaches in Asia and are actively seeking alternatives. In a much publicised event due to a decision of the Conseil d’État, the French government recalled the former French aircraft carrier ‘Clemenceau’ from its voyage to Alang, India, and it is now awaiting recycling in France under European standards of safety, health and environment.
No active ship recycling facilities exist in the EU that can accept vessels the size of an aircraft carrier, and few can accommodate commercial vessels of quite common sizes such as Suezmax or Panamax. The under-capacity and lack of special regulation and certification in ‘green’ recycling in Europe and elsewhere do not motivate today’s ship owners to accept a loss on the recycling value on a vessel, when legal options exist for trading vessels near their end-of-life on a global market place.

In the present trading situation, commercial vessels are only reluctantly removed from trading since freight rates are high, and consequently, the scrapping volume in Asia in all vessel categories are also at a low point. Eventually, it must be expected that an accumulated volume of aging vessels will be obsolete and available for scrapping once the market cools off, in addition to the single-hulled oil tankers as prescribed in EU and IMO legislation.

After discussion in the context of the Basel Convention, ILO and IMO, and a Joint Working Group of the three organisations, IMO is working on a proposal for a new convention on ship recycling with the IMO as the lead organisation. A first draft is available, but at present it may not adequately address several issues relevant to the Basel Convention and the EU Waste Shipment Regulation: Prior informed consent, the use of pre-cleaning, the requirements and certifications of the recycling facilities.

The ship owner organisations have, with some justification, claimed that the market for ‘green’ recycling was unclear with respect to standards and applicable rules. Therefore, a responsible ship owner who chooses upgraded facilities in China or Turkey could not be certain that the recycling was acknowledged and accepted as ‘green’ as defined in the Basel Convention and ILO Guidelines. Today, a few shipping companies have health, safety and environment policies on recycling that will require ‘green’ facilities if and when one of their vessels must be scrapped. One company has used a European facility (BP Shipping) and another (P&O Nedlloyd, now Maersk Line) has carried out upgrade and training in Chinese yards for the scrapping of several of their vessels. However, for the majority of shipping companies the added cost of ‘green’ recycling (in Asia approx. 15-25% of steel value) is equally important as the lack of certified recycling yards.

1.2 Objectives

The overall objective of the study is to provide information and guidance to the European Commission on the issue of ship dismantling especially with respect to the environmental, technical and economic aspects of the problem and of the available options to contribute to a solution at a European level.

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2 Basel Convention: Technical guidelines for the environmentally sound management of the full and partial dismantling of ships (December 2002); ILO: Safety and health in shipbreaking. Guidelines for Asian countries and Turkey (October 2003);
1.3 Outline of the report

Throughout the report the status and options are addressed relative to the political and administrative boundaries associated with the EU and the OECD. This generally leads to the following identifications:

a) The 27 EU member states;

b) The candidate countries Turkey and Croatia\(^3\) plus the EFTA country Norway;

c) The OECD countries USA, Canada, Mexico, Japan and South Korea;

d) Asian countries: Pakistan, India, Bangladesh, China.

The first section of the report comprises chapters 2, 3 and 4, respectively summarising the judicial and regulatory issues in the field of ship recycling, the volume and projected phase out of the government and merchant fleets over the coming years, and the current and potential capacity in safe and environmentally sound ship recycling.

The following two chapters 5 and 6 address specific challenges regarding international acceptance of the yards’ claims to safe and environmentally sound recycling and the technical viability and consequences of applying the pre-cleaning concept to ship recycling in EU and Asia.

Chapters 7 and 8 analyse the economics of carrying out ship scrapping in the EU, OECD or the Asian region, and address the drivers and incentives needed for a market demand to emerge under several of the options presented earlier in the study.

Chapter 8 is the conclusions' section and contains a number of recommendations on how to achieve a solution on a European and local level.

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\(^3\) The landlocked candidate country of the former Yugoslav Republic of Macedonia is not included
2 International governance of ship dismantling

This chapter provides an overview of the work and developments undertaken by the relevant IMO, Basel Convention and ILO bodies with regard to international governance on ship dismantling.

It contains a review of the draft IMO Convention on the Safe and Environmentally Sound Recycling of Ships being negotiated in the organisation's Marine Environment Protection Committee (MEPC) for adoption by a diplomatic conference in 2008/2009. The level of control and effectiveness in ensuring globally binding minimum standards for safe and environmentally sound recycling of ships is considered. Outstanding key issues are flagged.

With a view to compare the control level of the draft IMO Convention with that of the existing EU Waste Shipment Regulation, the chapter is commenced by an outline of the main EU and international instruments relevant for ship dismantling. In this context some recent examples of application of the Waste Shipment Regulation to ships for dismantling are provided.

2.1 Existing EU and international instruments relevant for ship dismantling

A broad range of EU legislation is applicable to end-of-life ships where it sets up binding environmental and safety requirements related to the dismantling activities themselves as well as the transfer of end-of-life ships for dismantling from and to the EU.

The Community waste legislation applies to the management of ships which have become waste. The Waste Framework Directive (Directive 2006/12/EC on waste), sets out a number of requirements, including safeguards for environmental protection during recovery or disposal, planning and permitting requirements, record-keeping and periodic inspections. This directive also lays down the definition of “waste” in its Article 1(a) as “any substance or object in the categories set out in Annex I which the holder discards or intends or is required to discard”.

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The shipment of end-of-life vessels within the EU or between its Member States and third countries are currently regulated by Regulation (EEC) No 259/93 on the supervision and control of shipments of waste within, into and out of the European Community\(^5\) (hereinafter the Waste Shipment Regulation)\(^6\).

The Waste Shipment Regulation determines which procedures to apply before a waste can be shipped within, into and out of the Community and is largely based on the United Nations’ Basel Convention, as amended\(^7\) and the OECD Decision C (2001)107 on revision of decision C (92)39/final on the control of transboundary movements of waste destined for recovery operations.

The Basel Convention establishes a control procedure for the export and import of hazardous waste between the parties of the convention. The procedure is based on prior notification of the export and import and written consent from the concerned authorities before the import or export takes place.

To ensure that the State of import has the necessary information to make an informed decision whether to accept or reject an import of waste, the Basel Convention requires that certain information is provided to the State of import. This information is listed in Annex V,A to the Convention and includes detailed information of the waste in question, proposed methods of transportation and disposal, as well as evidence of a contract between the exporter and the disposer. Confirmation is also required that the disposal contract specifies the environmentally sound management of the waste. The Basel Convention furthermore imposes an obligation (Article 4, para2) on each party not to allow export of hazardous waste or other waste and to prevent import of such waste "if it has reason to believe that the waste in question will not be managed in an environmentally sound manner". The Convention thus seeks to prevent that waste be deposited in a State that has not consented to such a transaction or which does not have the capacity to deal with the waste in an environmentally sound manner.

The Basel Convention also sets out specific steps to be taken (Article 8) when the notification procedure has been complied with, but the disposal cannot be completed in accordance with the terms of the disposal contract. The Convention places the responsibility on the State of export, which must ensure that the waste is taken back by the exporter, if alternative arrangements cannot be made...
for environmentally sound disposal of the waste within 90 days from the time the importing State informs the State of export and the Basel Convention Secretariat of the inability to complete the disposal in compliance with the contract.

The Convention contains a list of hazardous wastes and a list of non-hazardous wastes. The parties to the convention may unilaterally designate other wastes as hazardous.

It is an important feature of the Basel Convention control mechanism that it establishes a tracking system by which transboundary movements are monitored up to the issue of the final certificate of disposal.

It should be noted that disposal in the context of Basel Convention includes operations that lead to resource recovery, recycling, reclamation, direct reuse or alternative uses.

In 1995, an amendment to the Basel Convention was adopted banning all exports of hazardous waste destined for recovery from OECD or EU members to countries to which the OECD decision does not apply.\(^8\) The ban amendment has not come into force yet, as not sufficient parties have ratified it.

The EU has unilaterally implemented the ban (Council Decision 97/640/EC) meaning that the exports of hazardous waste from the EU to non-OECD countries are banned. Articles 14 and 16 of the Regulation thus ban the export of hazardous waste to non-OECD countries. No exemptions are possible.

Annex V to the regulation defines the wastes that fall under this export ban. End-of-life ships are not explicitly listed in Annex V. However, unless a ship has been built very recently it would in most cases contain hazardous substances listed in Annex V (e.g. asbestos under entries A 2050, 17 06 01 and 17 06 05 or PCBs under entries 16 01 09, 16 02 09 and 16 02 10) and would therefore be covered by the export ban.

The export and import of non-hazardous wastes are also covered by the Waste Shipment Regulation. For non-hazardous waste destined for recovery and contained in the "green list", it allows as a main rule that the destination country outside the OECD determines whether it wants to accept or ban the import of waste.\(^9\) At international level, non-hazardous wastes for recovery are covered by an OECD Decision\(^10\) and are not within the scope of the Basel Convention. Annex II to the EU Waste Shipment Regulation lists all "green" non-hazardous wastes and implements in this regard the OECD Decision. Pursuant to this Annex II, ships are considered non-hazardous if they fall under the entry GC 030

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\(^8\) Decision III/1 of the Third Conference of the Parties.

\(^9\) The Waste Shipment Regulation provides as introduction to Annex II that "regardless of whether or not wastes are included on this list, they may not be moved as green wastes if they are contaminated by other materials to an extent which (a) increases the risks associated with the waste sufficiently to render it inappropriate for inclusion in the amber or red lists, or (b) prevents the recovery of the waste in an environmentally sound manner."

‘vessels and other floating structures for breaking up, properly emptied of any cargo and other materials arising from the operation of the vessel, which may have been classified as dangerous substance or waste’. What the term ‘properly emptied’ means is not precisely defined in the OECD decision. An assessment of how the OECD decision term "properly emptied" may be interpreted both legally and technically is provided in Chapter 6 of this report.

It should be noted that export of non-hazardous waste destined for disposal in OECD countries other than EFTA countries which also are Parties to the Basel Convention is banned (Article 14). A recent Dutch judgement (of 21 February 2007) in the so-called Otapan case ruled that export of ships for dismantling which requires as a first step the removal and disposal of hazardous materials such as asbestos and PCB that cannot be recycled, constitutes an export for disposal.

The implication of the Dutch Otapan ruling, if applied in other cases, is that only ships which have been properly emptied can be dismantled in OECD countries other than EU and EFTA countries. The judgement is further analysed below.

To sum up, the Community legislation on waste, in particular the Waste Shipment Regulation, sets the requirements at EU level for management and shipments of end-of-life vessels. The export from Member States to non-OECD countries of end-of-life vessels considered as hazardous waste is banned according to the United Nations’ Basel Convention as amended. The ban is legally binding in the EU according to the Waste Shipment Regulation. It follows from Article 1(a) of Directive 2006/12 on waste and Article 2(a) of the Regulation that a ship becomes waste when it is discarded or is intended or required to be discarded11 – meaning from the moment that it is the intention of the owner not to use it as a ship anymore. A ship destined for dismantling is thus to be considered a waste. Whether the end-of-life ship is considered as ‘hazardous waste’ depends on the vessel’s contents of hazardous substances, and whether it has been ‘properly emptied’ of such substances.

11 The Basel Convention and the OECD Decision C (2001)107 on revision of decision C(92)39/final on the control of transboundary movements of waste destined for recovery operations contains similar waste definitions:
- The Basel Convention Article 2(1): “‘Waste” are substances or objects which are disposed of or are intended to be disposed of or are required to be disposed of by the provisions of national law’.
- OECD Decision C(2001)107, Chapter II, A(1): “WASTES are substances or objects, other than radioactive materials covered by other international agreements, which (i) are disposed of or are being recovered; or (ii) are intended to be disposed of or recovered; or (iii) are required, by the provisions of national law, to be disposed of or recovered”.
2.2 Recent cases of application of the WSR to ships for dismantling

The subjective element of definition of waste (the holder's intention to discard it) sometimes has made it difficult to effectively apply and enforce the Waste Shipment Regulation and/or the Basel Convention to end-of-life ship. One such example is the case of the Danish ferry Kong Frederik IX being sailed to India for dismantling.

In February 2005 the Danish Ministry of Environment became aware that a 51 year old Danish ferry named Kong Frederik IX, later renamed Frederik and after that Ricky, was to be sold possibly for recycling in India. It also became known that the ship contained asbestos. When the ship was sold it was docked in Denmark, but registered in St. Vincent and the Grenadines. The former owner of the ship, as well as the new owners, claimed that the ship was sold allegedly to be put in service in the Middle East as a cargo ship. The Danish authorities requested the involved parties to produce documentation on this. As declarations and documentation for this activity were produced, the national competent authority classified the ship as a non-waste and the ship left the Danish port on 16 March 2005. However, after having left the Danish port and Danish waters the ship sailed directly for recycling in India. The ship reached India on 22 April 2005.

Denmark is of the opinion that the export of this ship should be regarded as an export of hazardous waste, and as such falls under the Basel Convention. Furthermore, Denmark believes that as the exporting State, it has a responsibility to re-import the ship. India did not share this opinion. Denmark was not able to take action when the ship was anchored in the Danish port, since the new owner assured by a sworn statement that the ship was going to carry trailers as ro-ro cargo. By this sworn statement it was believed that the ship could not be classified as waste and hence could not be detained.

The ship was subsequently dismantled in September 2005 in India.

Whether the new owner decided to dismantle the ship while the ship was anchored in the Danish harbour (and as such provided the Danish authorities with false information), or whether this decision was taken in Danish waters or international waters, it has been argued that this case shows that we need an enforceable regime for ship dismantling.

The Waste Shipment Regulation has effectively been applied in a number of cases of export of ships for dismantling from EU Member States. This was the case of the Clemenceau, where the French air carrier was sent to India for recycling. It was made known to the Commission that the vessel had not been fully removed of its hazardous substances, especially asbestos. The Commission requested additional information from the French government and considered launching infringement procedure against France rejecting France's argument.

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12 See IMO MEPC 53/3/7 Proposal for an enforceable legally binding system for the recycling of ships, submitted by Denmark.
that the Clemenceau is not covered by EU waste rules because it is a warship. Subsequently, the French government recalled the Clemenceau in order to prepare it for safe recycling following a ruling from France's highest administrative court ruled that a decision to send it to India for dismantling was illegal.13

### The Otapan case

In the context of the Waste Shipment Regulation, the distinction between disposal and recycling has been a key issue in several cases. Most recently a Dutch Court (the Administrative Jurisdiction Division of the Council of State) on 21 February 2007 in the so-called Otapan case ruled that export of ships for dismantling which requires, as a first step, the removal and disposal of hazardous materials such as asbestos and PCB that cannot be recycled, constitutes an export for disposal.

The chemicals tanker Otapan left the Netherlands for Turkey at the end of July 2006. As the vessel had more asbestos on board than specified in the notification, Turkey refused to allow it to enter its territorial waters. The Dutch authorities (State Secretary for Housing, Spatial Planning and the Environment) then decided that the ship should return to the Netherlands. The proposed shipment was therefore not completed. It was apparent from the documents that it was proposed to send the vessel back to Turkey once the quantity of asbestos aboard has been brought into line with the notification.

The Dutch Court ruled that "the notification form […] states that the proposed shipment relates to a decommissioned tanker with asbestos-containing material on board. This operation is described on the form as recovery as referred to in Category R4 of Annex IIB to the Directive. A plan for the scrapping of the ship was attached as an annex to the form. In the Division’s opinion, it can be inferred from this that, contrary to what the defendant submitted at the hearing, the treatment of the waste specified in the notification is a process consisting of several stages. The scrapping plan states that the first part of the operation is to remove the asbestos in the ship. It follows from the plan that the removal of the asbestos is necessary in order to enable the ship to be scrapped. The plan also emphasises that no other work on the ship, for example the removal of liquids and gases, should start until the asbestos has been removed. In view of the above the Division considers that the waste treatment process is wrongly classified on the notification form as a recovery operation as referred to in category R4 of Annex IIB to the Directive. Nor is this altered by the fact that substances obtained from the dismantling of the ship will subsequently be transferred from the Simsekler yard to the metalworking industry for recycling, which could possibly be classified as a recovery operation. In these circumstances it must be concluded that the defendant wrongly failed to object to the proposed shipment on the ground of an incorrect classification on the notification form".

### Implications of the Dutch case

The implication of the Dutch Otapan ruling, if applied in other cases, is that only ships which have been properly emptied can be dismantled in OECD countries other than EU and EFTA countries, otherwise dismantling of EU ships can only take place within the EU.

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2.3 Work by IMO, Basel and ILO bodies

The problem of ship dismantling has been discussed for many years within the international organisations involved: the International Maritime Organisation (IMO), the International Labour Organisation (ILO) and the Basel Convention, a treaty under the auspices of the United Nations Environment Programme (UNEP). All three organisations have developed non-binding technical guidelines for ship recycling. The guidelines and their impact on ship recycling are presented in Chapter 5.

A Joint ILO, IMO and Basel Convention Working Group on Ship Scrapping has been established. It has held two meetings in 2005. At the meetings the Joint Working Group has discussed a co-ordinated approach to the issue in order to avoid duplication of work and overlapping of roles, responsibilities and competencies between the three organizations. The Group has undertaken a comparison of the technical guidelines of the three organisations. It has encouraged collaboration in their technical cooperation activities and has identified activities that could promote implementation of the guidelines. The Joint Working Group has furthermore addressed how a coordinated approach to all relevant aspects of ship scrapping may best be undertaken. In this context, the concept such as environmentally sound management and prior informed consent has been discussed and has, as further elaborated below, discussed an initial comparison between the Basel notification procedure and the proposed reporting system under the draft IMO Convention on the Safe and Environmentally Sound Recycling of Ships being negotiated in the organisation's Marine Environment Protection Committee (MEPC).

2.4 Review of the draft IMO Convention

Since 2005, the IMO has been working towards a binding international regime for clean ship dismantling. A draft Convention on the Safe and Environmentally Sound Recycling of Ships is being negotiated in the organisation's Marine Environment Protection Committee (MEPC) for adoption by a diplomatic conference in 2008/2009, to enter into force some years later.

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14 Basel Convention: Technical guidelines for the environmentally sound management of the full and partial dismantling of ships (December 2002); ILO: Safety and health in shipbreaking. Guidelines for Asian countries and Turkey (October 2003); IMO guidelines on ship recycling (December 2003).
16 At its 24th session, the Assembly of the International Maritime Organization (IMO), by its resolution A.981 (24), mandated the Marine Environment Protection Committee (MEPC) to develop a new legally-binding instrument on ship recycling. In its resolution, the IMO Assembly noted, among other things, the roles of the International Labour Organization and the Basel Convention in matters related to ship recycling.
Briefly about the draft IMO Ship Recycling Convention

It aims at a "cradle to grave" approach to ship recycling, with a view to avoiding hazardous materials in new ships and removing them from existing ships during their period of operation. It will set out specific requirements for the ship recycling facilities including authorisation of the facilities as well as a reporting system. Technical details, which also cover the environmentally sound management of ship recycling facilities, will be set out in recommended guidelines supplementing the Convention.

The draft Convention (as of January 2007) has an annex to which contains regulations divided in four chapters. Chapter 1 contains general provisions. Chapter 2 contains requirements for ships, divided into three parts (Part A on design, construction, operation and maintenance of ships; Part B on preparation for ship recycling; and Part C on surveys and certification). Chapter 3 contains requirements for recycling facilities, while Chapter 4 contains reporting requirements. Presently there are two appendices, the first one being particularly important as it contains the list of hazardous materials which are controlled by the Convention, while the second appendix provides standard formats for relevant certificates and other documents.

A large number of provisions are still to be agreed to. There are thus a rather large number of square brackets.

- amendments

The structure of the draft Convention is linked to the procedures for amending the Convention as defined in Article 18, which specify explicit acceptance by two thirds of the Parties to the Convention for amending Articles and a tacit procedure for amending the regulations contained in the Annex, whereby amendments would be deemed accepted unless one third of the Parties to the Convention notify their objection.

Guidelines

The following guidelines are foreseen to be developed:

General

• Guidelines for communication of information.

Guidelines for ships

• Guidelines for the development of Inventory of hazardous materials.
• Guidelines for the submission of a proposal to control hazardous materials.
• Guidelines for surveys and certification.
• Guidelines for inspection of ships.
• Guidelines for establishing gas-free-for-hot-work conditions.

Guidelines for ship recycling facilities

• Guidelines for authorization of ship recycling facilities.
• Guidelines for safe and environmentally sound ship recycling.
• Guidelines for the development of Ship Recycling Plan.

COWI
Next steps in the negotiations of the draft IMO Convention and its guidelines

In order to further develop the draft Convention and its guidelines, MEPC 55 in October 2006 agreed to convene an intersessional correspondence group and also an intersessional working group. The intersessional Correspondence Group, under the coordination of Norway would report on the outcome of its work to the intersessional Working Group scheduled to meet in May 2007 in the UK which would provide a report on the draft convention and related guidelines for further consideration by MEPC 56 (July 2007).

Following MEPC 56, the twenty-fifth regular session of the Assembly (3-14 December 2007) will decide on the holding of the Diplomatic Conference. MEPC 57 in March 2008 is scheduled to establish a Working Group and possibly to finalise work on the draft Convention. The one week Diplomatic Conference may be held sometime between February and April 2009.

Key outstanding issues

Controversial issues, which will be discussed by IMO working groups in 2007, include the question as to whether reference should be made to rules and standards outside the framework of IMO, the environmental baseline standard for ship recycling facilities, future reporting requirements (in particular whether state-to-state notification should be necessary as under the Basel Convention) and the type of compliance mechanism to help with implementation of the Convention.

The level of control and effectiveness

In the context of the Basel Convention, the key issue under discussion is whether the proposed Ship Recycling Convention will ensure an equivalent level of control and enforcement as under the Basel Convention. The 8th Conference of the Parties on 1 December 2006 reiterated this demand and stated, among other things, that the future legal instrument should generate conditions of ship dismantling that protect workers and the environment from the adverse impacts of hazardous wastes and unsafe working practices.

The Council in its conclusions of 21 November 2006 "emphasised that ship that are waste will continue to fall under the EU Waste Shipment Regulation as long as there is no internationally binding and effective legal instruments, which while addressing any special characteristics of ships, guarantee an equivalent level of control and enforceability as established under the Basel Convention". The Council also underlined that the future IMO Ship Recycling Convention should "generate real changes in the conditions under which "end-of-life" ships are dismantled, so as to protect workers and the environment from the adverse impacts of hazardous waste and dangerous working practices".

In the following, the level of control and effectiveness in ensuring globally binding minimum standards for safe and environmentally sound recycling of ships is considered. Focus is placed on the draft provisions (as of January 2007) which have been agreed to and key outstanding issues are flagged.

- scope

According to the current draft, the Convention - in line with other IMO instruments - will not apply to smaller vessels of less than 500 gross tons, nor to warships, naval auxiliary or other vessels which are state-owned or - operated and used only on non-commercial government service. It is provided, however, that "each Party shall ensure, by the adoption of appropriate measures, that such
ships act in a manner consistent with this Convention, so far as is reasonable and practicable."

The draft Convention sets out a number of mandatory requirements for ships with a view to avoid hazardous materials in new ships and removing them from existing ships during their period of operation. Each new ship shall thus have on board an Inventory of Hazardous Materials (Regulation 7). The inventory shall be approved by the Administration taking into account the guidelines developed by IMO. The inventory shall be specific to each ship and shall at least:

- identify hazardous materials, their location and approximate quantities;
- consist of Part I: materials contained in ship’s structure and equipment;
- clarify that the ship does not contain any materials which are prohibited under regulation 4.

The provisions for inventory for hazardous materials for existing ship have not yet been agreed to. There are currently two alternatives. The objective of the inventory of hazardous materials is to provide specific information on the location and quantities of potentially hazardous materials on board each ship so as to protect the health and safety of workers and also to prevent environmental pollution at the recycling facilities. Inventories will consist of three Parts:

- Part I: Materials contained in structures and equipment of the ship;
- Part II: Operationally generated wastes; and
- Part III: Stores.

The inventory is supplemented by a survey and certificate regime (Article 5 and Regulations 11 - 15). Presently, the draft Convention makes provisions for the following surveys:

- one initial survey; for new ships an initial survey would take place before the ship enters service, while for existing ships the survey would take place before the inventory is issued (existing ships are defined as ships built before the Convention enters into force);
- periodical surveys, on the basis of a five year cycle, verifying continuing compliance with the Convention and ensuring that any relevant alterations are reflected on the inventory;
- additional surveys, which the ship owner may request to take place at his option after alterations to the structure, machinery or equipment of the ship; and
- one final survey prior to the ship being taken out of service, so that all three Parts of the inventory are completed and checked, the Recycling Plan is examined and checked against the inventory, and the Ready for Recycling Certificate is issued.
### Requirements for recycling facilities

The most important requirements for recycling facilities are:

- mandatory development of ship recycling plan. The plan shall be developed by the recycling yard to specify the manner each ship will be recycled, depending on its particulars and its inventory. It shall take into account the non-binding guidelines developed by IMO;

- the introduction of the International Ready for Recycling Certificate, to be issued to the ship following its final survey verifying ship related statements on the Recycling Plan;

- the authorization of recycling facilities by their States, in accordance with the requirements of the Convention; and

- a Statement of Completion of Ship Recycling, issued by the recycling facility and reporting completion of recycling of an individual ship to the recycling State authorities and to the flag Administration.

The issue of pre-cleaning has been a divisive issue. Under the draft Convention, prior removal of hazardous materials may not be required if the recycling facility chosen is fully authorised to manage the type or amount of hazardous materials contained in the ship. The draft Convention seeks to match the individual ship's requirements and the capabilities of the recycling yard by means of a Recycling Plan and an International Ready for Recycling Certificate. However, there is still a need to clarify that, in case the final recycling facility is not capable of managing certain hazardous materials, the owner of an end-of-life ship must select another yard or remove the materials for safe disposal or recovery beforehand.

### Reporting requirements and compliance mechanism

As indicated above the future reporting requirements (in particular whether state-to-state notification should be necessary as under the Basel Convention) and the type of compliance mechanism to help with implementation of the Convention are some of the controversial issues to be discussed at the working ground meetings in 2007 and key outstanding issues assessing the level of control and enforcement.

While the mandatory system for inventory of hazardous materials and the associated survey and certificate regime sets out comprehensive requirements which may effectively be applied to all ships and thus generate change on the ground for the conditions under which end-of-life ships are dismantled, the current draft does not address in operational terms how new survey and certificate will be issued if the ship changes owner and/or flag. This is particularly relevant if the ship changes owner just prior to the recycling.

A number of provisions are relevant for control of the recycling facilities (Articles 4 (2), 6, 7, 8(1), 9(4), 10 (1), 12 (2) and (6), 13bis, 17 and 18 (2). Several of these provisions are of a generic nature. Furthermore, unlike a number of other IMO legally binding instruments, such as MARPOL on Port Reception
Facilities, the present draft IMO Ship Recycling Convention does not provide for dissemination of information on the web on IMO which often is seen as an effective mean to facilitate compliance and enforcement.

Finally while the IMO Convention may eventually provide for globally binding minimum standards for safe and environmentally sound recycling of ships, it should be noted that IMO conventions on average take six years to enter into force. The Convention would therefore most likely enter into force in 2013, at the earliest. The peak for phasing-out single hull tankers is expected around 2010.
3 Updated status and projections for European end-of-life ships until 2020

3.1 Introduction

The number and tonnage (LDT) to be scrapped until 2020 is assessed below and a status is provided for the historical developments with a special emphasis on the years 2004-2006.

For analytical purposes, the scrapped vessels have been split into eight type segments. The segmentation is based on a categorisation of the "sub types" used in Clarkson's databases consistent with the methodology used in the COWI/TREN study (2004).

The assessment of future decommissioning volumes also includes two additional types Fishing vessels and Warships and the assessment is therefore made for the following 10 'vessel types':

1. (Single hull) Oil tankers
2. Other tankers
3. Bulk
4. Container
5. Gas
6. Passenger/ro-ro/vehicle (including ferries)
7. Other cargo vessels
8. Non-cargo vessels
9. Fishing vessels
10. Warships

No distinction is made between the hull types of oil tankers. Details of the type and geographical segmentation are given in appendix 1 of the COWI/TREN study.

3.2 Historical decommissioning volumes

This chapter describes the recorded scrapping activity from 1994-2006, with a special emphasis on the years 2004-2006. A number of methodology details and assumptions are given in Appendix A.
3.2.1 Total volumes 1994 - 2006

The estimated level of historical scrapping are summarised in the figure below.

![Graph showing total historical ship scrapping volumes, all types (Million LDT, Million DWT and number of vessels).](image)

Figure 3-1 Total historical ship scrapping volumes, all types (Million LDT, Million DWT and number of vessels)

Note: Figures for 2003 and 2006 have been converted to full year.

From 1994-2006, approximately 5,600 ships have been demolished worldwide. There have been considerable variations in the activity level over the years. The ship scrapping activity peaked in 1999 with 600 ships being scrapped representing approximately 6.4 million LDT, while the scrapping activity in 2005 reached an "all time low" of only approximately 1.5 million LDT being scrapped.

3.2.2 Volumes by ship type

The historical scrapping volumes by ship type are shown in table below.

The volumes scrapped declined considerably from 2003 to 2004 and 2005 for all major ship types due to historically strong freight markets. It appears - on the basis of data for the first half of 2006 - that scrapping volumes are increasing due to relatively strong drops in the freight rates.
Figure 3-2  Historical scrapping volumes by ship type (million LDT)

It is seen in the above figure that the decommissioning volume has dropped for all ship types, but in particular the oil tankers are trading beyond their expected life time.

There are no EU records of the destination of warships, but usually the vessels are scrapped nationally or previously used for target practise, although this is not common today. The end-of-life destination for some larger vessels in recent years:

- In 2003 the frigate *HMS Scylla* was used as an artificial reef off Plymouth (UK).
- The German destroyer *Rommel* was scrapped in Turkey in 2004.
- The destroyer *Warszawa* and several other naval vessels were scrapped in Poland in 2004-2006.
- The training vessel *Lucifer II* is currently tendered for dismantling in Cherbourg, France, where scrapping of submarines also takes place.

Historically, in many European navies vessels are often sold for continued use in friendly nation’s navies, but for obsolete vessels it was not uncommon to sell for the scrap value to Asian ship breakers.
3.3 **Methodology for analysis of current fleet and future decommissioning volumes**

3.3.1 **Approach and assumptions**

A number of factors influence the future supply of vessels to the ship scrapping industry including the size of the existing fleet, the future earning potential, the cost of keeping the ship in operation, the age profile of existing fleet, the size of the current fleet, regulatory issues, budgets etc. The importance of the factors differs in vessel types and several approaches are used for the estimate of the current fleet and the projections. These are described briefly here and in details in Appendix A:

a) Vessel type 1. To facilitate comparison the single hull oil tankers are assumed to be phased out according to the same criteria as in the COWI/TREN study (2004).

b) Vessel type 2-9: These vessels are operating on commercial conditions and are not subject to phase-out regulation. They are phased out according to the type’s historical trading life expectancy, except for fishing vessels, which are estimated from other non-cargo vessels.

c) Vessel type 10, Warships: EU warships are obviously not operating on commercial conditions, but on the basis of the costs of keeping the vessel operating, the need for warships, political arguments, available budget etc. Regarding the future volumes of scrapping of warships it is simply assumed that all warships aged 25 or more will be scrapped during the next 14 years (2007-2020).

**Size limits**

The analysis focuses on vessels of 2,000 DWT and above for vessel type 1-8, fishing vessels of 500 GT and above\(^{17}\) and warships of 150 LDT and above. For the latter two types LDT is typically not given and conversion factors to derive LDT apply: LDT equals 54% of the GT for fishing vessels and 46% of the fully loaded weight for warships.

**Country grouping**

The projections of the future volumes of scrapping are made by flag state and country of ownership on the basis of the following definition:

a) *EU countries*: The 27 EU Member States.

b) *Non-EU countries*: All other countries (including accession countries).

\(^{17}\) The upper interval of vessels eligible for scrapping premiums in the EU exit scheme for fisheries, EC 2792/1999 is 500 GRT. Since in most cases the GT of a vessel is greater than its GRT slightly more vessels are included compared to the number of vessels subject to the EU exit scheme.
This implies that projections are made for 4 categories:

- EU flag/EU owned
- EU flag/Non-EU owned
- Non EU-flag/EU owned
- Non EU-flag/Non-EU owned

The analysis covers the global fleet of vessel types 1-5 and 7-8, but only fishing (vessel type 9) and naval vessels (vessel type 10) which are flying the flag of an EU Member State and passenger vessels (vessel type 6) sailing to and/or from an EU country.

The country of ownership for vessel types 1-5 and 7-8 is identified based on the information provided in the Clarkson database\(^{18}\), while the projections for fishing vessels (vessel type 9) are based on the Community Fleet Register.

It has not been possible to determine the country of ownership directly for passenger ships (vessel type 6). Instead it is assumed by looking at the vessels on each route in EU, that half the vessels are owned by the country of origin and half by the country of destination. The information on flag state and route specific information is based on data from Shippax 'Statistics and Outlook 06'. Data on European warships are obtained from Jane's Fighting Ships, Yearbook 2006-2007.

### 3.4 The current fleet

The composition of the current fleet of vessel types 1-10 is presented in this section. This information is used for estimating the future volumes of scrapping.

#### 3.4.1 Vessel type 1 - Single hull oil tankers

**All owner and flag state countries**

The composition of the existing fleet of single hull oil tankers is shown by year of delivery, category and hull type in Table B in Appendix A.

The total fleet of single hull oil tankers represents 19.8 million LDT, of which 3.3 million LDT are category 1 tankers. The equivalent numbers for category 2 and 3 tankers are 14.3 million LDT and 2.2 million LDT, respectively. Note that no distinction is made between single hull oil tankers equipped with double bottom (DB) and single hull oil tankers equipped with double sides (DS) as these are treated equal in the regulation.

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\(^{18}\) Please note the following statement from Clarkson: "The term "Owners" within this product is used as a simplified term for "Primary Reference Companies". The Primary Reference Company is defined as the company with the main commercial responsibility for the ship and can be Owner, Manager, Agent or other associated company. None of the information contained in this product is intended to confirm or otherwise the legal status of the companies or the ships associated with them."
The data in Appendix A shows that quite a lot of the tankers in operation should have been phased-out in previous years. A simple adjustment is made to counteract this artefact. Here it is simply assumed that these vessels are scrapped over the coming 5 years (ref. section 3.5).

The age profile of the existing fleet of single hull oil tankers is presented in the figure below.

![Age profile of current fleet of single hulled tankers - All owner and flag state countries, Vessel type 1 (single hull tankers) share of LDT. Due to the MARPOL recommendations no new single hilled tankers have entered the market for 10 years.](image)

**Figure 3-3** Age profile of current fleet of single hulled tankers - All owner and flag state countries, Vessel type 1 (single hull tankers) share of LDT. Due to the MARPOL recommendations no new single hilled tankers have entered the market for 10 years.

**Current fleet by owner/flag state**
The majority of the single hull tankers are owned by residents of non-EU countries, and only a minor share of the fleet is flying an EU-27 flag (see figure below).
3.4.2 Vessel types 2-8

All owner and flag state countries
The total fleet of ships of vessels type 2-8 represents 225 million LDT. Other tankers, bulkers and container vessels make up a very large share of the current fleet (see figure below).

Figure 3-4  The current fleet of single hulled tankers - By owner/flag state. Vessel type 1 (single hull tankers) in million LDT

Figure 3-5  Size of current fleet, Vessel type 2-8 (million LDT)
The figure below shows the age profile of the global fleet of vessel type 2-8.

![Age profile of current fleet - All owner and flag state countries, Vessel type 2-8 (Share of LDT)](image)

Note: Data for vessels type 6 does not cover global fleet, but only vessels sailing to and/or from an EU country.

**Figure 3-6  Age profile of current fleet - All owner and flag state countries, Vessel type 2-8 (Share of LDT)**

The figures shows that the fleet of container vessels and other tankers are relatively young compared to the other vessel types, whereas a large share of 'other cargo vessels' and 'passenger/ro-ro/vehicle' ships is old, more than 20 years.

**Current fleet by owner/flag state**

The projections of the future volumes of scrapping are, as mentioned previously, made by EU or non-EU flag state and EU or non-EU owner country.

The composition of the current fleet by owner country and flag state is shown in the figure below (information for passenger/ro-ro/vehicle is not included as only EU vessels are included in the data set).
Note: No data for vessel type 6, as analysis does not cover the total fleet.

Figure 3-7  The current fleet - By owner/flag state, Vessel type 2-8 (Million LDT)

It can be seen that:

- Few vessels are owned by a non-EU flag and at the same time flying the flag of an EU country (dark green).
- EU residents own a relatively large share of container vessels and 'other tankers'.
- Roughly half of the ships which are owned by an EU resident are flying the flag of an EU country (light green) and half of a non-EU country (yellow).

The data on vessels type 6 shows that close to 80% of the ferries, which are sailing to and/or from an EU country, are flying an EU flag.

3.4.3  Vessel type 9 - Fishing vessels
The total fleet of fishing vessels represents 1.1 million LDT, of which 31% are more than 25 years old (see figure below).

The fleet of fishing vessels is relatively old compared to the other ship categories.
The data reveals large differences in the age profile between the European countries. Several countries, especially Spain, Slovenia and Sweden have an old fishing fleet, whereas especially Belgium, Estonia and Poland have relatively young fishing fleets.

3.4.4 Vessel type 10 - Warships

The total fleet of warships represents 1.6 million LDT.

The age profile of the current fleet of warships is shown below by country in terms of LDT.
The figure reveals large differences in the age profiles of the Member States. In general, the fleets are considerably younger in the "old" Member States. Portugal has a relatively old fleet compared to the rest of the "old" EU Member States, with almost 60% of the vessels being more than 25 years old, whereas Romania has a relatively young fleet.

The table below shows the fleet of warships in terms of LDT and the number of ships by country.

It can be seen that 396 European warships are more than 25 years old equivalent to 396,000 LDT.
Table 3-1  The fleet of warships by country (no. and 1,000 LDT)

<table>
<thead>
<tr>
<th>Country</th>
<th>No. of ships</th>
<th>1,000 LDT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>&lt;25 years</td>
<td>+25 years</td>
</tr>
<tr>
<td></td>
<td>&lt;25 years</td>
<td>+25 years</td>
</tr>
<tr>
<td>Belgium</td>
<td>9</td>
<td>4</td>
</tr>
<tr>
<td>Bulgaria</td>
<td>6</td>
<td>23</td>
</tr>
<tr>
<td>Denmark</td>
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<td>15</td>
</tr>
<tr>
<td>Estonia</td>
<td>0</td>
<td>5</td>
</tr>
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<td>Finland</td>
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<td>France</td>
<td>122</td>
<td>34</td>
</tr>
<tr>
<td>Germany</td>
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<td>29</td>
</tr>
<tr>
<td>Greece</td>
<td>34</td>
<td>60</td>
</tr>
<tr>
<td>Ireland</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>Italy</td>
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<td>8</td>
</tr>
<tr>
<td>Latvia</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>Lithuania</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>Malta</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Netherlands</td>
<td>36</td>
<td>1</td>
</tr>
<tr>
<td>Poland</td>
<td>23</td>
<td>19</td>
</tr>
<tr>
<td>Portugal</td>
<td>9</td>
<td>16</td>
</tr>
<tr>
<td>Romania</td>
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<td>Spain</td>
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<td>35</td>
</tr>
<tr>
<td>Sweden</td>
<td>35</td>
<td>9</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>99</td>
<td>27</td>
</tr>
<tr>
<td>Grand Total</td>
<td>688</td>
<td>321</td>
</tr>
</tbody>
</table>

The age profile tabulated by type of vessel likewise reveals large differences (see figure below). Amphibious units are relatively young and the category misc., including survey and research ship, tugs, etc., is relatively old.

Admittedly, other government agencies than the Ministry of Defence may own vessels, e.g. a Fisheries Inspectorate, the Coast Guards, Ministry of Environment, Research Organisations etc. In fact, in the UK Defra (2007) found 20 agencies owning government vessels in addition to the Ministry of Defence. Further information is not readily available on these vessels in the EU.
3.5 Future scrapping volumes

3.5.1 Earlier projections

The COWI/TREN study included simple projections for the future scrapping activity for 2003-2015. The projections were based on a simple assessment of the age profile of the fleet (for all other vessel types than oil tankers) and the historically observed life time expectancy. For oil tankers the consequences of different phase-out schemes were assessed, i.e. the IMO MARPOL 13G and EC 1726/2003/Revised MARPOL Annex 1.

For the years 2004-2006 it was estimated that 7-10 million LDT would be scrapped per year, mainly consisting of bulk carrier, passenger/ro-ro/vehicle, other cargo vessels and oil tankers. The actual level of scrapping is much lower approximating an average of 2 million LDT/year from 2004 to 2006. Unless the average life expectancy remain several years higher than previously observed, this has obviously created a back log of until now some 15 million LDT to be scrapped in the future.

The main reason for this is as mentioned the strong freight markets, which is the main driver for the ship owners’ decision when to scrap (as documented in the COWI/TREN study).

The impressive increase in freight rates since 2002/2003 is illustrated in the figure below. It can be seen that the container time charter rates more than tri-
plied from early 2002 to early 2005 and the tanker segment has shown a similar development.

![Graph showing freight rates](image)

**Figure 3-11** Freight (time charter) rates. *Source: Container, Clarkson (2006), reading from graph; Tanker, Clarksons.net, reading from graph.*

It is emphasised that the present models of phase out do not include forecasts of freight rates and projects scrapping based on historical phase out patterns. Therefore, the recent years' high freight rates leading to continued trading of vessels previously considered at their end-of-life were not predicted and likewise a sudden drop in freight rates with subsequent massive scrapping will not be predicted.

### 3.5.2 Total fleet$^{19}$

The estimates of the future total volumes of demolition are shown in the Figure 3-12 below. The detailed volumes of demolition by vessel type and year of scrap can be seen in Table C in Appendix A.

The volumes of scrapping are estimated to fluctuate between around 5-10 million LDT/year during 2007-2020, except for 2010 where a large number of single hull tankers are phased-out. In total, it is estimated that 105 million LDT will be scrapped from 2007-2020.

The future volumes of scrap are estimated to start at a relatively high level for the next few years and then show a declining trend until 2016. From 2017 and onwards, the volume of scrapping is estimated to show an increasing trend.

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$^{19}$ Only including EU fishing vessels and EU warships. Furthermore, the fleet of Ro-Ros and ferries (type 6) do not cover total global fleet.
Not surprisingly bulkers, single hull oil tankers, container vessels and other cargo vessels account for the vast majority of future scrapping.

The annual decommissioning volumes of fishing vessels are projected to decrease until 2010 where after the annual volumes remains stable between 40,000 and 45,000 LDT.

As mentioned previously it is virtually impossible to forecast the future level of scrapping of warships. As an example the UK naval authorities will decommission approximately 30 naval vessels before 2013, but the majority of these are expected to be sold to foreign governments or to other uses that recycling (UK Defra 2006). The legacy ships that are expected to be recycled comprise five out of the thirty vessels. Two of the vessels are up to 20,000 tons.

In general, it seems fair to assume that warships which today are 25 years or older will be scrapped during the next 14 years (2007-2020). The fleet of European warships aged 25 or older represents 396,000 LDT. Hence annual scrapping of warships can be expected to be in the region of 28,000 LDT. In lack of suitable information it is assumed that the sale of navy vessels, which is not subtracted here, will balance the added vessels belonging to other government agencies. In the French report on demolition in European military fleets it is estimated that 300,000 LDT may be dismantled over the coming 10 years (MIDN 2007).

The sum of the projected annual scrapping volume for European warships and larger fishing vessels is approx. 70,000 LDT and compared to the merchant fleet it only account for a very small fraction (approx. 1%) of total scrapping.

As actual volumes are sensitive to the developments in the freight market, these numbers should only be seen as indicative for the level of scrapping.
3.5.3 By owner/flag state

Forecasts by country of ownership and flag state are shown in Figure 3-13 below. The detailed future volumes of demolition by owner/flag state and year of scrap can be seen in Table D in Appendix A.

Vessels owned by non-EU countries and flying the flag of non-EU countries account for the largest share of future scrapping - in the region of 3-6 million LDT/year, except for the peak in 2010 where a large number of single hull oil tankers are phased-out.

Scraping of vessels, which today are both EU flagged and EU owned, will amount to 1.1-1.8 million LDT/year, except for 2010.

EU owned vessels flying the flag of a non-EU country accounts for in the region of 1.0-1.9 million LDT/year.

Finally, EU flagged vessels which are owned by non-EU countries, will only account for scrapping of 0.2-0.3 million LDT/year.
Figure 3-13  Future volumes of demolition by owner/flag state and year of scrap - Vessel type 1-10 (Million LDT)

Table 3-2  Future volumes of demolition by owner/flag state and year of scrap - Vessel type 1-10 (Million LDT)

<table>
<thead>
<tr>
<th>Phase-out year</th>
<th>EU flag/EU owned</th>
<th>EU flag/Non-EU owned</th>
<th>Non EU-flag/EU owned</th>
<th>Non EU-flag/Non-EU owned</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007</td>
<td>1.8</td>
<td>0.2</td>
<td>1.9</td>
<td>6.0</td>
<td>9.9</td>
</tr>
<tr>
<td>2008</td>
<td>1.6</td>
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The share of vessels operating under a European Union member state flag is 22% measured as LDT\textsuperscript{20}. The vessels operated or owned by companies in the EU accounts for 40% and the combination accounts for 43% of the global LDT.

\textsuperscript{20} As of Clarkson database September 2006
4 Updated status of currently available and projected ship recycling and pre-cleaning capacity

The chapter examines the existing capacity for recycling of ships under safe and environmentally sound management conditions in the countries mentioned below.

- the 27 EU member states,
- the EU candidate countries Turkey and Croatia,
- the rest of the OECD and
- the non-OECD shipbreaking nations in Asia (Pakistan, India, Bangladesh and China).

The technical options for increasing the capacity of green recycling are discussed, and also addressed is the supply side to recycling in the EU and elsewhere, i.e. the vessels and the barriers for increasing their availability to recycling yards.

It is not attempted in this report to define the terminology regarding the reuse of ships. The major institutions and organisations have favoured their own terms: scrapping, dismantling, breaking, decommissioning and recycling. When the different terms are used in this report they are not implying a particular methodology, but rather the origin of the information treated. Since a common effort is carried out on an IMO Convention on Ship Recycling, this term is used in general. To emphasise the need for improved or internationally recognised conditions, the phrases “safe and environmentally sound” or “green recycling” are favoured.

The European Commission in 2001 published a study on Technological and Economic Feasibility Study of Ship Scraping in Europe. This study concluded that establishing dismantling capacity in Europe was not economically viable on market conditions. In the COWI/TREN report of 2004 a limited num-

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ber of European facilities listed at the time were engaged in shipbreaking or under establishment. Their business plans were typically based on government vessels in combination with offshore oilrigs decommissioning rather than the merchant fleet.

The present update shows that the majority of the planned facilities did not mature into active ship recycling facilities or they are still in the process of obtaining the necessary permits and licences from local authorities. However, the continued public pressure for avoiding the scrapping practises of Pakistan, India and Bangladesh, the phase out of single hulled tankers, and presumably the increased price on recycled steel have initiated more plans for European ship recycling facilities. It is clear that European ship recycling is still limited since practically all merchant vessels of size and scrap value are broken in Asia. It has also been stated in previous cost analysis that under the current legislative regime the economic feasibility of recycling yards based on merchant vessels are unrealistic. The mere lack of facilities and limited success in establishing new ones in the EU is a statement of this.

It must be emphasised that a yard’s capability to perform “green” recycling is very difficult to establish as there is no internationally recognised system for certifying recycling accordingly. In the contacts to industry in the present study the capacity is examined by the documentation made available by the yards or interviews with selected yards. The references to a yard’s certification (e.g. ISO, OSHA) and of approved, certified or similarly recognised companies and facilities for disposal of hazardous waste are taken as indication that “green” recycling is possible.

4.1 Facilities for green recycling in the EU

In the wake of the unsuccessful attempts to have the aircraft carrier Clemenceau scrapped in India or Turkey, the French government initiated an extensive survey of European and overseas facilities with a potential for dismantling a vessel of this size under appropriate concern for safety, health and environmental issues. The French Inter-ministerial Working Group on Ship Dismantling presented their draft findings during an EMSA workshop in September 2006 with the conclusion regarding Europe that:

There are some recycling capabilities of vessels in Europe (Belgium, the Netherlands, Italy, Lithuania and potentially Great-Britain) as well as in the others OECD countries (Turkey and eventually Norway).

It was clear that none of the sites visited by the French group were immediately ready to commence dismantling of a vessel the size class of Clemenceau, but with due preparation the technical feasibility was achievable at several sites across Europe (Lebaq 2006). This may also include sites in Le Havre and in Cherbourg, France, not previously engaged in recycling of large ships (Assemblée Nationale 2007).

The active European (EU-27) ship recyclers with existing capacity for vessels up to 150 m includes (see also appendix C):
Van Heyghen Recycling S.A. in Gent, Belgium, with a capacity of up to 60,000 LDT/year and a length of 265 m;

Scheepssloperij Nederland B.V. in s’Gravendeel, the Netherlands, with a capacity of 30,000 LDT/year;

Gdynia shipyard, in Gdynia, Poland has recently dismantled several naval vessels, including the destroyer "Warszawa". Capacity unknown;

Fornaes Aps in Grenaa and Smedegaarden in Esbjerg, both Denmark, have capacities of 30,000 and 20,000 LDT/year;

Desguaces de la Arena (Soto del Barco) in Spain can dismantle vessels up to 220 m length, but draught is presently limited;

Simont S.p.a. in the Port of Naples, Italy has a capacity of 80,000 LDT/year and has previously recycled large naval vessels. The company is presently most active in industrial demolition.

The present situation in the Campania region in Italy, under which jurisdiction Naples is placed, is that there are problems with waste management capacity, so that imports of waste from other regions are generally not allowed.

BP Shipping states in their annual report that three facilities are used and inspected by them in Spain. The annual capacity of these facilities has not been established, but the capability to perform green recycling has been demonstrated by the company.

It can be derived from the experience of the recent French study, the UK strategy, and the previous findings of the Danish study on OECD capacity that the level of implementation of EHS standards does vary in the visited yards, also within the EU. However, it is estimated that all yards in the course of one year would be able to comply with the requirements of the guideline of the Basel Convention (UNEP 2004).

4.1.1 Planned or dormant capacity for green recycling

Smaller facilities in EU

A number of facilities exist in most sea locked European countries for recycling of smaller vessels such as fishing vessels, barges, small naval vessels etc. E.g. in Poland 150 fishing vessels were recently scrapped in various locations along the Baltic coast (Gdańsk, Gdynia, Władysławowo, Kołobrzeg, Dziwnów), in Latvia and Lithuania several facilities recycle smaller vessels, and on the northern coast of Spain a number of pier breaking yards exist. In Bulgaria two facilities operate at Varna and Bourgas; in Greece two facilities (Bacopoulos and Savvas Pireus) dismantles smaller ferries, fishing and naval vessels.
The upgrade and expansion of these smaller facilities to green recycling of larger vessels will depend on the feasibility for physical expansion in the individual settings of each company, but also on the methodology used. It will often be relatively simple to move a pier breaking activity to another quay, whereas a facility using a dry dock or a synchrolift will be costly to expand.

**Ship dismantling facilities under establishment**

Two facilities in the United Kingdom are expected to be very close to come into operation in ship dismantling: The Able UK in Hartlepool and Harland & Wolf in Belfast. Both these sites have applied for ship dismantling licences to expand activities on existing sites and both will have the opportunity to accept larger vessels. The shipyard of Harland & Wolf possesses the largest dry docks in Europe which can accommodate vessel of any known size. Able UK, who is ready to dismantle vessels from the US Ghost Fleet, expected the necessary permits in the near future at the time of writing.

Bartin Recycling in France, known from its activity in recycling airplanes, and the company Europlasma have formed a consortium to recycle ships, in particular the aircraft carrier Clemenceau.

In the Baltic countries Latvia and Lithuania several companies are engaged in small vessel recycling or ship repair and maintenance. Several of the yards are engaged in feasibility studies, expanding existing or establishing new recycling facilities for larger vessels:

- **Latvia**
  - Liepajas Metalurgs, Liepaja
  - Kuusakoski, Riga

- **Lithuania**
  - Klapeidos Laivu Remontas, Klaipeda
  - Kuusakoski, Klaipeda
  - Subare, Klaipeda
  - Undoris JSC, Klaipeda

**Facilities for decommissioning of offshore structures in the EU**

It is still the case that the facilities established for decommissioning of offshore oilrigs and storage platforms often can be used for ship recycling. The facilities potentially available are:

- Shetland Decommissioning Company Ltd. in Greenhead Base, Lerwick Harbour, Shetland.

- KBR Caledonia, Nigg yard, Tain.

Using these facilities for recycling of ships will depend on the actual location and layout of the facility. It is clear that the companies involved in decommissioning offshore platforms do not see a profitable market in ship recycling under the current market conditions.
4.1.2 Projection for EU-27 facilities

Government and fishing vessels – the steady supply
From Chapter 4 it is evident that smaller yards exist in most EU countries facilitating the dismantling of inland and coastal vessels not suited for open sea travel to the major recycling areas of the World. The seven listed companies ready to scrap vessels up to 150 m and for one yard up to 220 m are sufficient for the vast majority of the vessels on the existing European recycling market, and to these can be added a few yards now ready to enter the recycling market with even larger facilities. Even without the latter the capacity is more than 150,000 LDT. Obviously, some of this capacity is already utilized for small vessels, but judging from the example from Poland, the capacity for smaller vessels is readily developed in other ports if a yard decides to take on the larger vessels.

Fishing vessels supply are projected to decrease from up to 70,000 LDT before 2010 where after the annual volumes stabilises between 40,000 and 45,000 LDT. The life time expectancy of warships, at least in peace time, is generally quite long (30 – 50 years). As mentioned in Chapter 2 it has been assumed that warships, which today are 25 years or older, will be scrapped during the next 14 years (2007-2020). The fleet of European warships aged 25 or older represents 396,000 LDT and 321 vessels. Hence, the annual scrapping of warships for the EU can be expected to be in the region of 28,000 LDT and 23 vessels.

Several of the companies mentioned in the previous chapter are tendering for the Clemenceau recycling and have found ways of technically handling even the aircraft carrier size class. Given the total affirmative supply on EU basis of less than 100,000 LDT/year from naval and fishing vessels and the scarcity of very large government owned vessels, it is technically and logistically possible to accommodate the need for recycling of vessels in the EU in the projected future of ten years.

In interviewing several yards it was also clear that even though they may currently experience too little draught in their facility to accommodate vessels of >7m, the yards considered dismantling topsides and freeboard outside the yards in port areas. As mentioned earlier not all yards appear to fully comply with the requirements of the guideline of the Basel Convention, but is it estimated that all would be able to in the course of one year.

In conclusion, for the limited supply of vessels from government and from the fishing industry, no technical constraints are foreseen for the EU capacity in ship recycling. However, the scrapping of government vessels may well be seen by local yards, the public and local/national authorities as an activity well suited for job creation programmes in former ship building communities. It is therefore uncertain whether an EU wide market for decommissioned government vessels will emerge. This possible supply constraint may seriously limit

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22 Nine countries, incl. navies of France, UK, Germany and Italy, have estimated their dismantling need until 2015 to approx. 110 vessels over 150 LDT (MIDN 2007).
the viability of green recycling yards in the EU. To counteract a yard would presumably seek to acquire vessels from the merchant fleet.

**The merchant fleet**

In Chapter 3 the projected volume for demolition for all the vessel types was given as (excl. the peak year 2010):

- 1.1-1.8 million LDT/year for EU flagged and EU owned (including fishing vessels and warships)
- 1.0-1.9 million LDT/year for EU owned vessels flying the flag of a non-EU country;
- 0.2-0.3 million LDT/year for EU flagged vessels which are owned by non-EU countries.

The vessels potentially up for recycling obviously comprise the part of the fleet close to their end-of-life, but it must be recalled that commercial vessels under EU flags are often sold to companies registered in non-EU countries a few or several years before their end-of-life. At present, there are limited possibilities for imposing a legal obligation on EU owners flying non EU flags to supply obsolete vessels to recycling yards of a certain standard acknowledged or certified internationally (see also Chapter 2).

Measured on LDT approx. 22% of all vessels operate under an EU member state flag and some 40% is registered as owned by an EU based company. Virtually none of these vessels are scrapped in Europe, where the recycled vessels only accounted for approx. 1% of the global decommissioning volume.

Assuming that the projection of vessels under European flag (1.3-2.1 million LDT) will also be scrapped in the EU, then the size profile of the vessels must be considered. Basically, recycling of a ship requires a space large enough for the structure, mechanical equipment in various levels of sophistication, and workers trained in safe recycling. The two latter are easy to obtain, whereas the former may be more challenging depending on the standards required.

Advantages of establishing ship recycling facilities in the UK are given in the Defra report (Defra 2007), but they will apply on an EU scale as well:

- The possibility of investment in safer, more efficient mechanisation of many of the processes undertaken manually in developing countries;
- Removal of hazardous materials by staff with appropriate expertise, using safe and environmentally sound techniques and equipment. The UK has access to such staff and equipment;
- A highly developed domestic and EU legal and regulatory infrastructure and effective enforcement of standards; and,
A tradition of market-led innovation and development providing good opportunities for British industry to benefit from the worldwide demands for environmentally sound ship recycling facilities.

Any requirements of technical modification of existing yards and pier breaking activities as a result of international agreements, e.g. a coming IMO Convention, should be readily achievable. Today compliance to safety, health and environmental standards in ship recycling typically of smaller vessels are achieved by way of member state licensing and monitoring (see Chapter 5). There is no reason to believe that larger facilities employing the known methodology should exceed the capacity of authorities’ inspectors and regulators.

**Dry dock recommendation**

If it is considered mandatory to use a dry dock for green recycling, there will be a constraint to consider, in particular for the very largest vessels. The large dry docks in the EU (e.g. Gdynia, Poland; Constantza and Mangalia, Romania) and the very large docks (e.g. Belfast, United Kingdom; Hoboken, Belgium; Cadiz, Spain) can physically accommodate the relatively few obsolete VLCCs and ULCCs under EU member state flags. However, most of the docks, although they may presently be underutilised, are used for refits and repairs and their availability for ship recycling is a matter of profitability. The few large docks still engaged in new building in the EU, presumably have a profitable niche production and may not be available for recycling activities.23

An extract from Clarksons’ demolition database for large EU flagged vessels ready for decommissioning in the years up to 2020 (older than 1995 and >100,000 DWT) shows that 43 vessels presently under a European flag will be recycled (assuming they are not reflagged to non EU member states in that period!). Of the 43 on the list (all tankers) 20 are single hulled tankers to be phased out in 2005 and seven are category 2 tankers, which must be phased out by 2010. The IMO regulation allows certain exemptions which may allow further trading, but in a worst case scenario 27 vessels will soon await recycling and 12 of these are >200,000 DWT (VLCC) requiring the limited large dry docking capacity. If only the three largest dry docks can accommodate them, it follows that over four years one vessel should be dismantled in each dry dock.

Obviously, if both the vessels OWNED by EU registered companies and the vessels FLAGGED in the EU member states must be recycled in the EU or OECD, then the number of vessels competing for a limited dry dock capacity will increase. Still under the assumption that all vessels will maintain the flag and ownership construction, some 103 vessels are to be scrapped in the EU until 2020 – corresponding to eight vessels per year. However, 55 are single skins that are to be phased out by the end of 2007 unless exempted.

Up to 41 will be >200,000 DWT (VLCC), so large that they may only be recycled in the largest dry docks. Assuming the same capacity in three European yards as planned in the Pipavav facility in India, 12 VLCC can be dismantled

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23 Reference is made to table 8.3 Dry-docks with a capacity above 60,000 DWT in COWI7TREN (2004)
per year. This suggests that vessels may have to be laid up, that more facilities should be included or that dry docking should be combined with pre-cleaning and topsides dismantling while moored at a pier.

**Pier breaking accepted**

The claim for dry docks by the NGOs is based on the recommendations of the ESM guideline of the Basel Convention because the text mentions “impermeable surface” as a requirement during dismantling. This requirement is currently interpreted as the ships' hull may serve as an impermeable barrier and in combination with a wet barrier (a boom) the existing methods of pier breaking and slipway breaking do comply. If the pier breaking methods continue to be accepted as green recycling there is a large dormant capacity meeting the physical dimension requirements in ports and waterways throughout the EU, even for very large vessels. In practice, pier breaking are often combined with docking capacity or slipway for the breaking of the keel.

**Pre-cleaning capacity**

Pre-cleaning without scrapping afterwards is not carried out in any EU member state harbour on a regular basis. An example of pre-cleaning is the former UK navy vessel, HMS Scylla, which was decontaminated prior to being sunk off Whitsand Bay near Plymouth to become an artificial reef. In such cases, the London Convention Specific Guidelines for Assessment of Vessels will apply (UK 2006b).

Clearing a vessel for hazardous waste or pre-cleaning it is generally not seen as a market area for the yards since they are typically borne out of the metal recycling business. This task is usually outsourced to specialist companies that may perform most of the activity while the vessel is moored in port rather than on the yard premises. Thus, pre-cleaning of vessels should not obstruct utilising the yard’s capacity for scrapping of the hulls, although with larger and more complicated constructions the cleaning may be more intermittent with the actual dismantling.

On an *ad hoc* basis the Dutch authorities had the *Sandrien* and the *Otapan* pre-cleaned (see Chapter 2 for legal implications of pre-cleaning). Also, the French authorities had the *Clemenceau* pre-cleaned prior to departure for Turkey. In several EU countries regulations exist as to the requirements for the pre-cleaning of obsolete vessels prior to the use as targets for naval and military shooting practise. Thus, the skills and facilities for pre-cleaning of ships are available, but the scope and intermittent need for the service has not led to the emergence of a viable market.

It is clear that pre-cleaning has been an arduous and time consuming process in these cases. Several of the vessels were pre-cleaned for more than 12 months. In yards engaged in the subsequent scrapping it is estimated that pre-cleaning takes 4-7 weeks.
4.2 Facilities in EU candidate countries Turkey and Croatia and EFTA country Norway

The shipbreaking facilities in Aliaga, Turkey

There are some 25 plots for shipbreaking in Aliaga that are operative today. The procedure can be characterised as slipway recycling: there is a considerable draught near the coast and even large vessels of 10,000 LDT and more are run ashore. The vessel is cut from the bow and sections of 600-800 tonnes are cut and pulled onto the cutting area by wrenches. Smaller sections and equipment are removed by cranes. Vehicles and cranes can operate close to the vessel on the shore or on barges.

The plots are situated on Government property previously leased for only five years at a time. In 2006 the lease terms were changed and leases now runs for 20 years. The longer perspective is considered by the Turkish Shipbreaking Association (TSA) to increase the willingness with yard owners to invest in safety, health and environmental improvements of the yards.

The yards were the topic of a critical Greenpeace report (Greenpeace 2002), and since then a hazardous waste programme has been initiated by the TSA, who hired a manager with hazardous waste management responsibilities. This has led to improved procedures in yards and the programme also increased the availability of facilities for hazardous waste: a mobile asbestos decontamination unit, an organised oily waste collection, and hazardous waste reception facilities are now available to the yards. Some yards (e.g. Cemas) have now large concrete paved areas for the cutting procedures; others have invested in their own asbestos unit and oil pumping and storage facilities not to mention obtaining ISO 9001, ISO 14001 and OHSAS 18001 certification (Leyal Ship Dismantling & Recycling)\textsuperscript{24}. The Simsekler yard was chosen by both French and Dutch authorities for the proposed recycling of the Clemenceau and the Otapan, respectively.

Compared to the situation described in the Greenpeace report in 2002, the improvements in several yards in Aliaga are significant. A compliance with the requirements of the Basel Convention Guideline on Ship Dismantling is not a far fetched possibility (Neser et al 2006), although the acceptance of wet recycling is a prerequisite.

The full annual capacity has previously been given as 600,000 LDT with 800-1200 employees (~500 LDT/man year), but recent estimates by one of the recycling yards brings the number up to 1,000,000 LDT/year (Ayvatoglu 2006).

\textsuperscript{24} Impressions from a visit to Aliaga by Frank Stuer-Lauridsen and Danish EPA in April 2006 (Note to the Danish EPA: Shipbreaking in Aliaga, Turkey)
Shipyard facilities in Croatia
There are five major shipyards in Croatia organised in a joint company where the Croatian Government holds a majority of shares. There are no reports on ship recycling of larger vessels, but the yards in Brodotrogir and Kraljevica are involved in ship repair activities for vessels up to 50,000 and 25,000 DWT, respectively.

4.2.2 Upgrading in Turkey and Croatia

Turkey
The options for upgrading facilities in the OECD country Turkey is particularly interesting for the EU, since Turkey is in a pre-accession mode and therefore is underway with adhering to the EU legislation. Thus, if the capacity of the existing shipbreaking facilities in Aliaga close to Izmir meets the appropriate standards, EU vessels can be exported thereto without violating the Basel Convention, the Ban amendment or Waste Shipment Regulation.

The facilities in Aliaga are only accountable as safe recycling facilities if dry docking is not a requirement. The methodology of landing on the shore and pulling the vessel a shore and cut it from the bow may need to be refined. This may be achieved by using pontoon bridges or barges along the vessel to accommodate the use of heavy equipment alongside the vessel and at the same time reducing the wave action on the grounded vessel.

It is a possibility to pre-clean vessels in the EU and to tow the emptied hulls to scrapping in Turkey. In this case, however, the transport to a non-OECD country is legal and may be more profitable.

Croatia
The options for using Croatian yards for shipbreaking are similar to the EU and Turkish conditions in terms of the need for adherence to the EU acquis. There are no reports on any interest in ship recycling of larger vessels in Croatia.

4.2.3 EFTA country Norway
Norway has a number of facilities that may enter the ship recycling market for larger vessels. A facility in Norway (Fosen Gjenvinning AS) is active on the demolition market for smaller vessels and may be upgradeable to accommodate larger vessels. No plans have been published.

Three facilities in Norway: Aker Stord, Norsk Metallretur Offshore Recycling AS and AF Decom AS are active in the decommissioning market for offshore platforms. None of these have any current plans of entering the ship recycling market.
4.3 Green ship dismantling facilities outside EU and European OECD countries

The companies shown below have identified themselves as ISO 14001 and/or OSHA 18001 certified or they are situated in an OECD country and as such a priori acceptable for export of vessels for recycling from the EU. Since Norway and Turkey have been included previously, this would include the OECD countries Australia, Canada, Japan, Korea, Mexico, New Zealand and USA.

4.3.1 OECD countries

USA
During 2006 there were seven ship recycling facilities operating in the USA located in Brownsville, Texas; New Orleans, Louisiana, Norfolk, Virginia and Baltimore, Maryland. Their clients are MARAD, the U.S. Navy or commercial operators. The approximate total capacity in the U.S. is 225,000 tons per year at the facilities. The four companies located in Brownsville, Texas can accommodate a total 150,000 tons per year, with International Shipbreaking Limited providing one-third of the total Brownsville capacity. Vessels for recycling have not been imported to the USA in recent years. The USA is not a Party to the Basel Convention, and the import would fall under the Toxic Substances Control Act (TSCA), which also prescribes a pre-notification. The US EPA has stated that an application to import a ship would require a 9 - 12 months public review and approval process and that the license to import the vessel would be limited to one year.

Canada
In Port Colborne, Ontario, the International Marine Salvage Inc. dismantles Canadian and imported vessels in a facility that is ISO 14001 certified. The company has recycled in excess of 150,000 tons of steel from dismantling ships since 1985. This steel has primarily been re-melted into new steel by domestic steel producer, but substantial tonnage has also been transported to various mills in Asia, for re-rolling into new bars and structural shapes. Canada is a signatory to the Basel Convention.

Other OECD countries
No recycling facilities for larger vessels have been identified in Australia, Japan, South Korea, Mexico, New Zealand or Iceland. Japan and Korea were scrapping nations in the 1970s and 1980s and Mexico had a scrapping industry until the 1990s. The Mexican Industry was partly based on vessels exported from the USA. The countries will, however, typically have marine salvage companies with some access to breaking facilities, but these are typically repair and maintenance yards and only used for scrapping vessels on an ad hoc basis.

Besides the USA, the only OECD country with any significant ship recycling industry is Turkey.

25 Switzerland not included.
26 Information on USA provided by John Graykowski, Director of Marine Recycling Consultants/International Shipbreaking Limited
4.3.2 Exporting to other OECD countries

Recycling facilities on both the Atlantic and Pacific coasts of the Americas will be useful considering that a merchant vessel may be *en route* or in any given port in these waters when a decision to scrap is taken.

At present the majority of active green recycling capacity is located in the USA due to the US Navy and MARAD demand for ship scrapping under acceptable safety, health and environmental conditions. There is no clear indication that the American facilities may operate on an open international market and become available for foreign vessels for scrap.

The Canadian facility has catered primarily for the domestic market, but has recently expressed interest in operating on the international market in particular regarding government vessels. There is a size limitation to the import of ocean going vessels as they must pass the locks of the Welland Canal.

4.4 Asia and non-OECD countries

In the countries typically ranked as prime shipbreaking countries national associations of shipbreakers exist, and some of them or other authorities have initiated activities to upgrade their national ship recycling yards. This is especially true for China and to some extent India. In both countries some ship recyclers have obtained the quality management ISO 9001 certifications.

**India**

According to press releases from Gujarat Maritime Board, which is the managing authority of the shipbreaking on Alang Beach, 22 companies in Alang area have received ISO 14001 and/or OSHA 18001 certification. A list of 32 facilities in Alang certified for ISO 18801 and OHSAS 18001 was available from a cash buyer. Most yards were certified by International Certification Services (Asia) Pvt. Ltd., and some through the classification society RINA. Three yards with a combined annual capacity of 60,000 to 100,000 LDT present their certifications on their company homepages on the internet.

According to the Gujarat Pollution Control Board the yards at Alang now have access to a Treatment, Storage and Disposal Facility (TSDF) for hazardous waste from the ship breaking activities (Gujarat Pollution Control Board 2006).

The Pipavav facility near Alang is a large semi dry dock facility constructed for “green” recycling of up to four VLCCs at a time. It was developed by private Indian funds and financial assistance from Japan in the form of loans. It is presently not active in the recycling market.

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28 List from GMS of certified ship yards in Alang in 2006
**China**

In the late 1990s P&O Nedlloyd was challenged to improve their decommissioning practices and the company subsequently changed its policy on the matter. They chose two yards near Shanghai and initiated a capacity building project on safe recycling. P&O Nedlloyd ended up recycling 19 vessels in China between 2000 and 2003 under the company’s supervision. On the shoulders of this effort, the Chinese National Shipbreaking Association initiated a campaign to upgrade the safety, health and environmental issues at four yards, partly supported by the China – Netherlands Environmental Protection Cooperation Project (2005). Chinese authorities regulated shipbreaking specifically already in 1988, and recently implemented the “General regulations on green ship recycling” and “Technical guideline for Pollution Prevention related to Shipbreaking” from 2005 and 2006, respectively.

At least four yards have achieved ISO 14001 and OSHA 18001, i.e. the certifications regarding management of environment and health and at the recent IMO Regional Seminar and Workshop held 5-8 February 2007 in Zhu Hai, China, the companies capable of recycling large vessels (VLCCs and ULCCs) in China were given as:

- Xin Hui Shuang Shui Ship Breaking & Steel Co. LTD
- Zhongxin Shipbreaking & Steel Co.
- PanYu Ship Breaking and Steel Rolling Co.
- Chang Jiang Ship Breaking Yard.

The capacities have previously been given as <100,000 – 300,000 LDT/year for each yard and collectively amount to >800,000 LDT/year. In the autumn of 2006, China NSA carried out a trial on ship recycling in accordance with the draft convention on ship recycling. The trial took place at Chang Jiang Ship Breaking Yard on the container ship Nedlloyd Dubai (BIMCO 2007). This yard was also used during the first Chinese “green” ship breaking campaign in 2000-2003.

**Pakistan and Bangladesh**

It has not been possible to identify shipbreakers in Bangladesh or Pakistan with certifications regarding health or environment, such as ISO 14001 and OSHA 18001. The ILO project on ship recycling in Bangladesh did not report on any certified yards (Feringa 2005), but the PHP Group is reportedly seeking certification for a yard in Chittagong. No information is available from Pakistan.

**Other countries**

Japan has supported developments of shipbreaking in the West Cebu in the Philippines and as previously mentioned provided financial assistance to the construction of the Pipavav facility near the Alang area. None of these enterprises have proved viable in the shipbreaking market. Also, Vietnam is engaged in the shipbreaking market but presently only on a very limited scale (1% of tonnage). No information is available to assess the relevant compliance level of these facilities.
4.4.2 Projections for Asian yards

According to press releases from the Gujarat Maritime Board, 22 facilities at Alang have reported compliance to ISO 14001 on environmental management, and information from the cash buyer GMS lists 32 yards with ISO/OHSAS certifications in Alang. It is emphasised that although the present study is focused on environmental issues, the acceptance of a yard as an operator in safe and environmentally sound ship recycling includes the procedures of safety and human health issues. Issues regarding certification are further discussed in Chapter 5.

The Pipavav Ship Dismantling Engineering Limited may still be considered a dormant recycling facility located at the Pipavav Port in the State of Gujarat some 70 kilometres from Alang Beach. The facility was constructed with the aim of meeting the new standards for environmental protection and was finalised in 2003. It was built by Sumitomo Corp. of Japan for Gujarat Pipavav Port Ltd. with a loan from Overseas Economic Corp. Fund of Japan to provide a safer recycling than the nearby Alang beach, but has now been converted to a ship building yard.

The dimensions and procedures of the Pipavav facility have been described before (COWI/TREN 2004), but in brief it is two sloping wet docks each with a length of 680 meters and widths of 60 and 65 meters, respectively. The first 70% of the dismantling of a vessel is performed at the deeper end of a dock and the vessel is moved to the shallow dock end during a high tide where the remaining 30% of the dismantling is performed. The docking capacity allows dismantling of four vessels simultaneously. The annual dismantling capacity under normal conditions is planned to be 275,000 LTD with an optimal capacity of some 400,000 LDT. Unfortunately, no ship has to date been recycled at the facility.

According to the IMO MEPC seminar in February 2007 in Zhu Hai, China, the capacity is more than 3,000,000 LDT/year, and it is estimated that 800,000 LDT/year is in yards that have ISO and OSHA certifications or have had procedures upgraded and audited by P&O Nedloyd. The latter yard has projected expansions to provide capacity for up to 1,000,000 LDT/year, bringing the total green capacity up to 1500,000 LDT/year.

4.5 Summary of existing and projected capacity and recycling need

The existing capacity of green recycling worldwide may approach 200,000 LDT/year in the EU, but is at present not suitable for vessels of VLCC size and larger.

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29 List received from GMS of certified ship yards in Alang in 2006
30 Information provided to Frank Stuer-Lauridsen during a site visit in November 2005.
Table 4-1 Summary of existing and dormant capacity for safe and environmentally sound ship recycling.

<table>
<thead>
<tr>
<th>Safe and environmentally sound ship recycling</th>
<th>Existing capacity</th>
<th>Dormant if dry dock required</th>
<th>Dormant capacity by pier or landing method</th>
</tr>
</thead>
<tbody>
<tr>
<td>EU</td>
<td>200,000</td>
<td>1,000,000</td>
<td>Large</td>
</tr>
<tr>
<td>Candidate countries (Turkey)**</td>
<td>50,000</td>
<td>-</td>
<td>600,000 – 1,000,000</td>
</tr>
<tr>
<td>OECD (US + Can)</td>
<td>225,000</td>
<td>Not estimated</td>
<td>Not estimated</td>
</tr>
<tr>
<td>Asia***</td>
<td>800,000</td>
<td>Not estimated</td>
<td>1,500,000 – 3,000,000</td>
</tr>
<tr>
<td>Total</td>
<td>1,325,000</td>
<td>1,000,000</td>
<td>1,950,000 – 4,000,000</td>
</tr>
</tbody>
</table>

* Assuming three docks with the same combined capacity as the design capacity of the former Pipavav facility in India (400,000 LDT/year) + Able UK with a planned capacity up to 600,000 LDT/year.
** The capacity in Turkey is yet not fully accepted as green recycling.
***Chinese yards. Information from IMO MEPC seminar in Zhu Hai, China suggest expandable to 3,000,000 LDT/year.

The above-mentioned Indian yards with certifications would add >1,000,000 LDT/year to the global green capacity. However, with the present knowledge of containment employed in the beaching method, the yards cannot be accepted as green recycling.

Table 4-2 Comparison of existing and dormant safe and environmentally sound recycling capacity with the potential supply of government vessels and merchant vessels

<table>
<thead>
<tr>
<th>EU Government vessels and fishing vessels</th>
<th>LDT/year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recycling demand</td>
<td>40,000</td>
</tr>
<tr>
<td>Existing EU capacity</td>
<td>200,000</td>
</tr>
<tr>
<td>Balance</td>
<td>+160,000</td>
</tr>
<tr>
<td>Capacity need</td>
<td>No extra capacity needed</td>
</tr>
<tr>
<td>Certified facility in Turkey*</td>
<td>50,000</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>European flagged merchant fleet</th>
<th>LDT/year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recycling demand</td>
<td>1,600,000</td>
</tr>
<tr>
<td>Existing EU</td>
<td>200,000</td>
</tr>
<tr>
<td>Mobilisable in EU (existing infrastructure)</td>
<td>1,000,000</td>
</tr>
<tr>
<td>Balance</td>
<td>-400,000</td>
</tr>
<tr>
<td>Capacity need</td>
<td>Extra capacity needed</td>
</tr>
<tr>
<td>Mobilisable capacity in Turkey*</td>
<td>600,000</td>
</tr>
<tr>
<td>Certified facilities in China*</td>
<td>1,500,000</td>
</tr>
</tbody>
</table>

* The capacity in Turkey and China is not yet fully accepted as safe and environmentally sound recycling and the facilities in China are outside of OECD.
In summary, the existing European capacity will be sufficient for the fishing vessels, navy vessels and other government owned vessels to be recycled over the next 10 years. To provide green recycling in the EU for the merchant fleet presently under EU member state flag the dormant capacity must be invigorated. The number of potential facilities and the physical dimensions of the potentially available structures are just sufficient to accommodate the maximum sizes of the fleet, but several dry docks must be opened for recycling. It will also be necessary to continue to use pier breaking for pre-cleaning and partial dismantling.

However, it should be kept in mind that the demand for scrapping of 1.6 million LDT/year of EU member states flagged vessels is an average of a range up to 2.1 million LDT/year excluding the year 2010. The demand for recycling of EU member state flagged vessels in the peak phase out year of 2010 is projected to 2.7 million LDT. If vessels owned by companies in EU member states are included one may add 3.1 million LDT for recycling in 2010.

Obviously, capacity cannot be established for a single peak in the demand, but additional capacity will be needed for average years to ensure the access of European merchant ship owners to certifiable green recycling. This additional capacity can to some extent be found in Turkey provided the shore landing methodology is accepted as safe dismantling. The capacity available or mobilisable in China adds significant volume to the demand that can be met for green recycling. However, since China is not a member of the OECD the yards may at present only come into play for EU-flagged ships that are not exported for scrapping from the Community, i.e. ships that do not begin their final voyage in an EU port.
5 Overview of standards and guidelines for ship dismantling

This section draws an overview of existing standards of environmentally sound management in ship dismantling. The overview briefly outlines and compares the existing standards with special attention to the methods applied by the standards, also addressing if a certification system and third party accreditation is included in the different standards.

The overview further includes Environmental Health and Safety standards (EHS) of international organisations, which could be applied to ship dismantling. The applicability of the guidelines towards controlling EHS-issues in ship dismantling is analysed.

Finally, the overview includes guidance developed by EU member states, other flag and recycling states as well as shipping associations and private shipping lines, for which the existence of company policies directly on ship recycling or environmental policies including ship recycling is described.

5.1 Existing standards and guidelines on safe and environmentally sound management in ship dismantling

Several international standards and guidelines on safe and environmentally sound recycling of ships have been developed by different international organisations and national governments.

The list below includes the identified standards and guidance documents related to the recycling of vessels:

- UN bodies technical guidelines
  - Basel Convention Technical Guidelines for the Environmentally Sound Management of the Full and Partial Dismantling of Ships
  - ILO: Safety and health in shipbreaking: Guidelines for Asian countries and Turkey
  - IMO Guidelines on ship recycling
- Specific guidance on pre-cleaning and decontamination
- IMO Guidelines for the Development of the Ship Recycling Plan
- IMO recommendations & guidance on “Gas-free-for-hot-work-certification” during ship recycling operations

- Industry codes and standard contracts
  - ICS Industry Code of Practice on Ship Recycling
  - ICS Inventory of Potentially Hazardous Materials on Board

- Practical manuals on ship dismantling

5.1.1 IMO, ILO and Basel Convention Guidelines

The three United Nations bodies: the International Maritime Organisation (IMO), the International Labour Organisation (ILO) and the Conference of Parties to the Basel Convention on the Control of Trans-boundary Movements of Hazardous Wastes (the Basel Convention) are among those who have been engaged in the area for the longest period and produced the most detailed guidelines within the field. However, none of the three guidelines are mandatory and the practical application of them to date has been limited.

In the recognition of the need for coordination of their work with the aim of avoiding duplication of work and overlapping of roles, responsibilities and competencies between the three organizations, a joint working group on ship scrapping was established in 2005. The work and outcome of the joint working on ship scrapping established by IMO, ILO and the Basel Convention is described in Chapter 2.

Besides this joint work IMO have themselves initiated work on developing a binding International Convention for the Safe and Environmentally Sound Recycling of Ships, the IMO Convention on Safe and Environmentally Sound Recycling of Ships. This Convention is described and analysed in more detail in Chapter 2.

In parallel to the negotiation of a binding international regime for clean ship dismantling, a number of guidelines are currently being prepared. The guidelines will supplement the IMO Convention.
Proposed Guidelines for the IMO Convention on Ship Recycling

The following is the provisional list of nine guidelines for the ship recycling Convention, grouped into three:

- **General**
  - Guidelines for communication of information.

- **Guidelines for ships**
  - Guidelines for the development of Inventory of hazardous materials
  - Guidelines for the submission of a proposal to control hazardous materials
  - Guidelines for surveys and certification
  - Guidelines for inspection of ships
  - Guidelines for establishing gas-free-for-hot-work conditions.

- **Guidelines for ship recycling yards**
  - Guidelines for authorization of ship recycling yards
  - Guidelines for safe and environmentally sound ship recycling
  - Guidelines for the development of Ship Recycling Plan.

At MEPC 55 the intercessional Correspondence Group was tasked with the development of an outline of one or two pages for each guideline.

Some guidelines are further developed already by the Correspondence Group including the guidelines for ship recycling yards on safe and environmentally sound ship recycling, which is being drafted by Japan. The primary intentions of this draft guideline are to provide information to operators of ship recycling facilities to enable them to understand how to comply with the ESM requirements of the Convention.

The Japanese draft guideline for ship recycling yards on safe and environmentally sound ship recycling details the ESM requirements of the Convention after it has entered into force. The requirements are specified for the four different methods: beaching, landing, afloat and dry. Specifically regarding beaching, the draft guideline specifies that strict management requirements are necessary and that the method is not recommended for newly-established facilities. An example of a specific requirement for the beaching method is installation of appropriate oil reception and/or storage apparatus adjacent to the beached hull, in order to collect residual oil, solvents used for sludge, and/or oil cleaning.

The draft guideline is still under negotiation and its final destiny is not known at the time of writing.

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5.2 Existing international EHS standards

Besides the above referred international standards and guidance on environmentally sound management in ship recycling as described above, different international standards and guidance on EHS-management exist. The most widespread EHS-standard which can be and is being used to control the environmental impacts of ship recycling is the environmental standard ISO 14001 and the standard for occupational health OHSAS 18001.

These standards are described and analysed below. Focus is on their applicability in ship recycling, hereunder features about the standard that needs special attention.

5.2.1 ISO 14001

The International Organization for Standardization, ISO, is a non governmental organisation that has developed the widespread environmental standard, ISO14000, which consist of a series of voluntary standards and reference documents designed to provide the general framework for organizing the tasks necessary for effective environmental management.

Frequently, the series of standards are referred to as ISO 14001, because this is the number of the actual standard. All other sections in the series are support documents, including guidelines for implementation, environmental auditing, environmental labelling, and product life cycle assessment.

The ISO 14001 standard is a generic management system standard, which means that the same standards can be applied to any organization, large or small and whatever its product or the scope of activity is. The ISO 14001 standard must be followed by third-party verification to obtain certification towards the standard.

The first section of the standard directs the organization to identify its activities, products, or services that can or already significantly impact the environment.

Secondly, the organization must develop an environmental policy “appropriate to the nature and scale” of the activities, products, or services with significant environmental impacts. There must be a specific commitment to prevent pollution. Top management must define the policy and ensure that it is communicated to all employees. In the policy, the organization must commit to comply with all pertinent environmental legislation, regulations, and/or legal requirements. Perhaps most important, the section directs the organization to set, review, and document definable environmental objectives and targets at relevant functions and levels within the organization.

In the third section of the standard, the organization must develop a program for achieving its management objectives. The program will include assigning responsibility for objectives at “each relevant function and level of the organization” and establishing a time frame for their accomplishment.
The fourth major section of the standard calls for the implementation and operation of the environmental management program. This section includes provisions to educate employees or members at each relevant function and level about the organization’s environmental management system and their roles and responsibilities in achieving the organization’s goals. In addition, the provisions call for training of employees or members to carry out their tasks within the environmental management system. Finally, within Implementation and Operation, there must be procedures for preventing and mitigating any environmental impacts from accidents and emergency situations. The Checking and Corrective Action section directs the organization to monitor and measure operations with significant environmental impacts on a regular basis. The organization must establish and maintain a documented procedure for evaluating compliance with pertinent environmental laws and regulations. The standard calls for a continuous audit of compliance with and performance of the environmental management system. Finally, the standard requires that top management review the environmental management system and provide changes to policy, objectives or operations when necessary which should lead to greater efficiency and continual improvement.

ISO 14001 does not include a requirement for the firm to make its environmental performance available to the public.

5.2.2 OHSAS 18001

The OHSAS 18000 series of standards that includes OHSAS 18001 Occupational Health and Safety Management Systems (OHSMS) grew out of the international success of, amongst others, the ISO 14000 series of standards and the need for managing safety in the work environment. This standard was created from the British Standard for Occupational Health and Safety Management Systems BS 8800:1996.

Description

The OHSAS 18001 came into effect in April 1999. Its full title is "Occupational health and safety management systems - specification". There is a second document in the series (OHSAS 18002), which provides guidelines on the implementation of OHSAS 18001.

OHSAS 18001 is based partly on the ISO 14001 diagram on plan, do, check and improve.

According to the scope of the OHSAS 18001 specification it is applicable to any organization that wishes to:

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32 The ILO also has a standard entitled ILO-OSH 2001. The ILO Guidelines on occupational safety and health management systems (ILO-OSH 2001) were adopted at a tripartite Meeting of experts in April 2001. The ILO Governing Body has approved the publication of the Guidelines.
• establish an OH&S management system to eliminate or minimize risk to employees and other interested parties who may be exposed to OH&S risks associated with its activities;
• implement, maintain and continually improve an OH&S management system;
• assure itself of its conformance with its stated OH&S policy;
• demonstrate such conformance to others;
• seek certification/registration of its OH&S management system by an external organization; or
• make a self-determination and declaration of conformance with this OHSAS specification.

5.2.3 EMAS

The EU Eco-Management and Audit Scheme (EMAS) is a management tool for companies and other organisations to evaluate, report and improve their environmental performance. The scheme has been available for participation by companies since 1995 (Council Regulation (EEC) No 1836/93 of 29 June 1993) and was originally restricted to companies in industrial sectors.

Since 2001 EMAS has been open to all economic sectors including public and private services (Regulation (EC) No 761/2001 of the European Parliament and of the Council of 19 March 2001). At this point EMAS recognized ISO 14001 as equivalent to the environmental management system required by EMAS.

The mentioned revisions to EMAS have made it easier for organisations already certified to ISO 14001 to attain EMAS registration. For these organisations there will be some minor modifications to be made relating to the core elements of ISO 14001 plus some additional steps specific to EMAS.

Additional steps for EMAS registration:

1. Initial Environmental Review - The EMAS regulation requires that an initial environmental review be performed to identify an organisation's environmental aspects. However, when an organisation already has an EMS certified to ISO 14001 it does not need to conduct a formal environmental review when moving on to EMAS implementation, so long as the environmental aspects (including both direct as indirect environmental impacts) as set out in EMAS are fully considered in the certified environmental management system (EMS).

2. Environmental Statement - The organisation shall prepare an environmental statement, based on the outcome of the EMS performance audit. The environmental statement must openly report the environmental performance of the organisation.

3. Verifying the Environmental Statement and environmental performance - In order to attain EMAS registration, the Environmental Statement
must be independently validated. This process will check that the statement meets the requirements of EMAS and is publicly available.

From the above description it is obvious that the EMAS requires more transparency of the registered organisation than ISO 14001. EMAS requires that the policy, programme, environmental management system and details of the organisation’s performance are made publicly available as part of the environmental statement. ISO only requires that the policy is publicly available. Further ISO14001 does not stipulate the extent to which performance must be improved. EMAS specifies that organisations must attempt to "reduce environmental impacts to levels not exceeding these corresponding to economically viable application of best available technology".

Therefore, it is much easier from the outside of a company to control the actual performance of an EMAS organisation compared to one certified according to ISO 14001.

Participation under the EMAS scheme is voluntary and extends to public or private organisations operating in the European Union and the European Economic Area (EEA) — Iceland, Liechtenstein, and Norway. An increasing number of candidate countries are also implementing the scheme in preparation for their accession to the EU. It is presently not possible for organisations in other countries outside the EU to be registered under the EMAS scheme. However, according to Commission sources, this will probably be changed in the next EMAS revision which is being drafted. The new EMAS is proposed to allow registration outside EU and to reinforce requirements for legal compliance and documentation of performance improvements. The new EMAS is expected to be active from 2010.

5.2.4 Applicability of standards in ship recycling

The ISO 14001 standard and to a lesser extent the OHSAS 18001 standard are already being used in the ship scrapping business with recycling yards being certified according to the standards.

Both standards are generic and are thus not designed specifically to ship scrapping industries, and some features about the standard are important to keep in mind when evaluating the applicability of the standard. The EMAS scheme is less relevant because it can only be used for organisations within the European Union and the European Economic Area (EEA) and some EU candidate countries. However, this may be changed in the next revision of the standard.

First of all, it is important to bear in mind that ISO 14001 is an environmental management standard and OHSAS 18001 is an occupational health and safety standard. Certification towards ISO 14001 does therefore not include requirements on proper management of the working environment for workers at the site and vice versa for OHSAS 18001.

Secondly, it should be stressed that both standards are procedural as opposed to performance standards. Therefore, by itself certification against the standard does not guarantee a certain high level of performance. Being a procedural
standard means that the standards requirements are referring the organisation’s management system (procedures etc.) and not the level of performance. The minimum requirement of an ISO 14001 certified organisation is legal compliance to environmental regulations and continuous improvement. The speed and scope of the improvements is however up to the organisation itself.

The above mentioned requirement of the standards about the regulatory compliance is another important issue, when evaluating the applicability of them towards ensuring sound environmental management within ship scrapping businesses. Many of the large ship scrapping businesses are located in parts of the world where the EHS legislation and regulatory framework are not fully developed, which means that EHS regulatory compliance of a certified company in for instance Asia can easily allow for unacceptable EHS performance according to for instance European environmental legislative requirements.

Finally, a very important issue is the fact that both ISO 14001 and OHSAS 18001 allow for an organisation to certify only part of its activities. Because of this, a firm can choose to bring only a part of its enterprise and business activities under the regime of the standard, thereby leaving processes that are more difficult to manage and improve from an environmental perspective outside the scope of its certificate. Such proceedings can lead to serious misunderstandings about the value of the environmental management system. Therefore it is not enough to check if an organisation is certified according to these standards. It is also necessary to check the actual certificate to see which part of the organisation is covered, and possibly to check the documents behind to fully understand the scope of the certification. This information is, however, often not available as the standards (except EMAS) only requires the policy to be public available.

EMAS requires that the policy, programme, environmental management system and details of the organisation’s performance are made public available as part of the environmental statement. Further the statement is verified by an external third part certified auditor. Therefore it is always possible to control the environmental performance of an EMAS registered company.

A certified management system does not guarantee a certain level of performance except from legal compliance. Therefore it is necessary to establish documentation of best practise / best available technology. With this in hand it will be possible to evaluate the performance of a ship-recycling company. Such documentation can be used by both local authorities in the permitting process and by ship owners seeking a proper recycling facility.

A certified management system is valuable as it sets the framework for an organisation’s environmental or health and safety work, but seen from the outside it needs to include a requirement for transparent reporting (like the EMAS scheme). And when it comes to evaluation of performance it is also needed to have documentation of best practise / best available technology.

Further, it will be valuable to have guidelines for local authorities on how to handle permitting and inspection and guidelines for ship owners on how to handle the recycling process.
5.2.5 Existing certifications of recycling yards

As mentioned a number of ship recycling facilities are apparently already certified according to one of the above-mentioned standards. There is however no combined international register of certified companies according to ISO 14001 or OHSAS 18001. A register of EMAS registered organisations exists on the EMAS helpdesk (http://ec.europa.eu/environment/emas/tools/contacts/helpdesk_en.htm), but no ship recycling yards were found.

A brief search on the Internet and a few other available data sources have been performed with the result listed in the table below. It should be noted that the list is nowhere comprehensive.
Table 5-1  Existing ISO 14001 and/or OHSAS 18001 certified recycling facilities as identified through a search on the internet, interviews and other available data sources

<table>
<thead>
<tr>
<th>Country</th>
<th>Recycling yard</th>
<th>Certificate /standard</th>
<th>Certification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canada</td>
<td>International Marine Salvage</td>
<td>ISO 14001</td>
<td>Information Bulletin on Ship Demolition #6, Sept/Nov 2006 as the first ISO 14001 certified shipyard in the world. Documentation not found.</td>
</tr>
<tr>
<td>India</td>
<td>Shree Ram Shipping Industries, Shree Ram Steel &amp; Rolling Industries (unit 2) and Shree Ram Vessel Scrap PVT. LTD</td>
<td>ISO 9001, ISO 14001 and OHSAS 18001 certification by CISQ (Italy)</td>
<td>IQNet (The International Certification Network: <a href="http://www.iqnet-certification.com">www.iqnet-certification.com</a>) <a href="http://shreeramgroup.net/e_&amp;_s_01.htm">http://shreeramgroup.net/e_&amp;_s_01.htm</a></td>
</tr>
<tr>
<td>India</td>
<td>R. K. Industries (Unit 2)</td>
<td>ISO 9001, ISO 14001 and OHSAS 18001 certification by CISQ (Italy).</td>
<td>IQNet (The International Certification Network: <a href="http://www.iqnet-certification.com">www.iqnet-certification.com</a>)</td>
</tr>
<tr>
<td>India</td>
<td>Baijinat Melaram Ship Breakers, Bhavnagar</td>
<td>ISO 14001</td>
<td>Mentioned on yard home page by RINA (Italy)</td>
</tr>
<tr>
<td>India</td>
<td>Priya Blue Industries PVT LTD</td>
<td>ISO 14001</td>
<td>Mentioned on yard home page by ICS (India)</td>
</tr>
<tr>
<td>India</td>
<td>32 identified companies at Alang</td>
<td>ISO 14001 and OHSAS 18001</td>
<td>According to information from Gujarat Maritime Board and cashbuyer GMS. No further information has been supplied.</td>
</tr>
<tr>
<td>China</td>
<td>Jiangmen City Zhongxin Shipbreaking Steel &amp; Iron CO., Ltd</td>
<td>ISO14001 and OHSAS 18001</td>
<td>Beijing World Standard Certification Center surveillance audit (China) <a href="http://www.greenshipbreaking.com/">http://www.greenshipbreaking.com/</a></td>
</tr>
<tr>
<td>China</td>
<td>Jiangyin Changjiang Xiagang Ship breaking Company</td>
<td>ISO 14001 and OHSAS 18001</td>
<td>P&amp;O Nedlloyd (now Maersk) partner</td>
</tr>
<tr>
<td>China</td>
<td>Xin Rong Recycling &amp; Logistics Co. Ltd (formerly Jiangsu Changrong Steel Co.)</td>
<td>ISO 14001 and OHSAS 18001</td>
<td>ABS Quality Evaluations Available at <a href="http://www.changrongsteel.com/">http://www.changrongsteel.com/</a></td>
</tr>
<tr>
<td>China</td>
<td>Guangzhou Panyu Ship Breaking &amp; Steel Rolling Co**</td>
<td>ISO 14001 and OHSAS 18001</td>
<td>Indicated by CNSA on Zhuhai MEPC seminar</td>
</tr>
</tbody>
</table>
5.3 European Union guidance

As described in the previous chapter, the EU Waste Shipment Regulation specifically mentions vessels in its Annex III as acceptable to export once ‘properly emptied’:

- Vessels and other floating structures for breaking up, properly emptied of any cargo and other materials arising from the operation of the vessel which may have been classified as a dangerous substance or waste.

There is no EU guidance related to the cleaning of vessels for export, but several member states have initiated activities on this issue, notably the Netherlands, France, Denmark and the United Kingdom.

5.3.1 The Netherlands

The Netherlands have obtained practical experience with recycling of contaminated ships and pre-cleaning of ships as a result of the two ships Sandrien and Otapan being left/arrested in the Port of Amsterdam and taken over by the Dutch Government. The Otapan case is described in more detail in Chapter 1.

5.3.2 France

In preparation for the planned export of the former aircraft carrier Clemenceau pre-cleaning was carried out by French contractors in the Port of Toulon:

“All the necessary technical and industrial means were implemented to guarantee the respect of the objectives set by International and European environmental regulations, even though there are no European or International binding regulations regarding ship clean-up or dismantling. The dismantling yard is also certified with ISO 14001 on environmental management systems.”

The efforts concentrated on asbestos, sludge, oil and radioactive materials:

“Prior to the dismantling process, the former Clemenceau’s hull was processed and does not contain anymore:

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33 Dismantling of the former aircraft carrier Clemenceau (Press Docket MINISTÈRE DE LA DÉFENSE, January 3 2006)
- Hydrocarbons: all parts of the aircraft carrier with existing or previous hydrocarbons were leached and had their tanks emptied between October 1997 and January 1998. The concerned parts were then filled with freshwater.

- Polychlorobiphenyle (PCB)/pyralene. Like all the transformers on French Navy ships, the former Clemenceau transformers were “dry” transformers meaning that they did not contain such substances.

- The 1,238 indicative radio luminescent plates on the former Clemenceau were all removed before the beginning of the asbestos removal works.”

Procedures and standards for pre-cleaning are embedded in environmental legislation and no specific procedure addressing this has been developed. As mentioned earlier, a significant effort has been made by the Interministerial Working Group on identifying the need and capacity of European ship scrapping.

The planned dismantling of a naval vessel *Lucifer II* in 2007 will take place in Cherbourg at a site where obsolete nuclear submarines are already dismantled (Assemblée Nationale 2007).

### 5.3.3 Denmark

The Danish EPA have been active in ship recycling for a number of years. Their work has included investigation of available ship scrapping capacity within OECD-countries. The latest initiative includes development of a draft brief “pocket-book” version of the existing *Technical Guidelines for the Environmentally Sound Management of the Full and Partial Dismantling of Ships* published by the Basel Convention in 2003.

This pocket book primarily aimed at the operators of yards interested in entering the market for green recycling through upgrading of an existing yard. The information in the book is given at the level where the management and their contractors can develop the actual plan for upgrading based on the guidance and the information sources given.

The pocket book does not in itself include a certification system and third party accreditation, but is instead a step towards development of a standard for EHS certification of recycling yards.

### 5.3.4 United Kingdom

The UK Government was faced with the issue of ship recycling in 2003, when the US Department of Transportation Maritime Administration (MARAD) arranged to recycle 13 of its redundant naval vessels at a Teesside facility (Able Ltd.), and the public and local authorities challenged the status of the permissions at the facility.
In the wake of the Ghost fleet issue, the UK published a Strategy and a Consultation Paper and carried out an inventory of ship dismantling capacity in the UK. With respect to Government owned vessels, the Strategy and Consultation paper emphasises (UK Defra 2007) that when “Government owned vessels are either sold for further use to other Governments or commercial entities, or recycled, the following commitments will apply:

- the sales contract for a vessel destined for further use will contain conditions to ensure that the new owner takes full responsibility for the safe and environmentally sound recycling of the vessel;
- recycling will only be allowed in a facility in an OECD country and in accordance with acceptable environmental, health and safety standards; and,
- vessels exported outside the UK for recycling will be subject to the Basel Convention principles of prior-informed consent and environmentally sound management.”

The second document is an Overview of the Ship Recycling Process in the UK. It sets out the technical and regulatory requirements for operating sustainable ship recycling facilities in the UK. In addition, a non-exhaustive list of potential sources of assistance, including funding, for those wishing to engage in the industry is provided.

The UK Government’s view is that existing legislation on waste does cover ship recycling regardless of whether the ship sails under own power or has to be towed. The Strategy requires any ship sent for recycling from the UK to be recycled at a yard that operates according to standards of environmentally sound management. To this end the Strategy is available in five languages in addition to English.

There are three key provisions relevant to ship owners outlined in the Strategy. Firstly, any UK-flagged vessel being exported for recycling from a UK port will have to be notified according to the requirements set out in the WSR as described above. Secondly, all import of vessels into the UK for recycling will also be subject to the provisions of the Waste Shipment Regulations (or existing international rules). Finally, UK ship owners are encouraged to refer to the IMO Guidelines on Ship Recycling at all stages when a ship is sold for recycling.

5.4 Guidance in other nations

Most of the large ship scrapping nations have developed or are working on developing specific guidelines or standards describing procedures for scrapping of ships within their country. Below are presented the identified national guidelines.
5.4.1 India
The Central Pollution Control Board in Delhi has prepared environmental guidelines for ship scrapping industries aiming to minimize the effect of the industries on the surrounding environment through proper location of industries and by preparing and implementing an environmental management plan and a disaster management plan. The guidelines include a description of the appropriate pollution control measures regarding solid waste, air pollution, water pollution and noise. This also includes aspects of workers’ safety.

Since 2000, the Gujarat Maritime Board, GMB, has issued regulations covering safety measures for the beaching of vessels. Substance of the regulation was the documentation of a gas-free certificate before beaching and a permission to start the cutting operations to be issued by GMB following the removal of hazardous materials from the vessel. The gas-free certificate was introduced in 2001.

Apart from the third-party gas-free certificates no certification system or third party accreditation exists.

The Gujarat Maritime Board has issued Conditions and Procedures for Granting Permissions for Utilising Ship Recycling Plots, dated 30 September 2006. Schedule V (Miscellaneous) contains the following condition:

"(6) Permission holder shall use modern technology for recycling activity like use of long nozzle cutting torch, mechanised hydraulic lifting equipments, use of gas detectors, mechanized blowers, classified cutting equipments etc. and which may be prescribed by Gujarat Maritime Board from time to time and according to the norms prescribed by Basal Convention shall have to be strictly observed" (GMB 2006).

5.4.2 China
The State Environmental Protection Administration (SEPA) has published a technical manual on preventing pollution from ship demolition. SEPA has initiated work on registration of the Chinese ship scrapping facilities with the objectives to rank these according to their environmental status. The ranking will, reportedly, be linked to ship scrapping licences. Furthermore, SEPA is about to set up a school on ship scrapping (Blankestijn, 2004).

In 1991, the China National Ship Recycling Association (CNSA) was established to take up the responsibility of organizing, managing, co-ordinating and serving this trade, and assist SEPA to observe and supervise the pollution problems arising from ship recycling. CNSA have drafted “General regulations on green ship recycling” (available only in Chinese), which has been in force since June 2005.

In the autumn of 2006, CNSA carried out a trial on ship recycling in accordance with the draft IMO convention on ship recycling. The trial took place at Chang Jiang Ship Breaking Yard on the container ship Nedloyd Dubai. The
objectives of the trial was to find out the differences between Chinese ship recycling industry standards and international standards, and to evaluate the affects the convention brought to the Chinese ship recycling industry. Furthermore, the intention was to study preparatory measures, and to improve occupational safety and health as well as environment protection in the ship recycling industry (BIMCO 2007).

CNSA prepared a detailed scheme for the trial, with the draft convention as amended by MEPC 54 as basis, and the relevant ship recycling guidelines as reference. According to recent information (BIMCO 2007) the trial was considered a success and it was concluded that the recycling operation of the vessel essentially complied with the relevant guidelines and the draft convention - mainly because of the yard being capable to do this, and the ship owner keeping strict superintendence of the whole recycling process. Based on observations from delegates on site for the trial, there is no reason to believe that Chinese yards will have difficulties complying with the (expected) requirements of the IMO convention – also in the interim period from the approval until entering into force (BIMCO 2007).

China National Ship breaking Corporation Jiangyin Changjiang Xiagang Ship breaking Company is the yard upgraded and used by P&O Nedlloyd. It has documented procedures and formal certification.

5.4.3 Bangladesh

A national regulatory framework for managing ship scrapping is currently to be established. This reportedly includes an approval procedure for the site operator under the responsibility of the Ministry of Commerce and Industry, issuing a “berthing certificate” for each individual vessel to be scrapped and a “hot work” certificate. Presently, however, not all yards are registered with this ministry.

Further, 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, Ministry of Forest and Environment. To achieve this, the ship breaking site must establish an environmental management plan. The Environmental Law is also to cover safety measures, occupational health, waste management, monitoring programmes and disaster management.

ILO has performed a project on Safe and Environment-friendly Ship Recycling (SAFEREC) in Bangladesh (ILO 2003). According to this project there is very little implementation of the above-mentioned regulation in the yards and no enforcement of the “hot work” requirement.

5.4.4 United States of America

The United States Environmental Protection Agency, US EPA has developed a set of guidelines for ship scrapping in the United States. The guidelines, 'A
Guide for Ship Scrappers: Tips for Regulatory Compliance’ were issued in the summer of 2000 (US EPA, 2000).

The guidelines are a compliance assistance tool, intended to provide site supervisors at ship scrapping facilities with an overview of the most pertinent environmental and workers health and safety requirements to assist them in ensuring compliance at their facility. OSHA, the US Occupational Safety and Health Administration obviously also has regulations applicable to ship recycling and works together with the EPA on the issue.

Six active ship recycling facilities exist in the US in 2006. These are approved by MARAD to recycle their old vessels of which more than 100 are from the so-called ghost fleet. These facilities are apparently not open to foreign vessels, but the yards do pursue this issue with the authorities.

5.5 Recycling policies and strategies of private shipping associations and companies

5.5.1 International Chamber of Shipping, ICS

The International Chamber of Shipping, ICS is the international trade association for merchant ship operators. In February 1999, the Industry Working Party on Ship Recycling, IWPSR was established under the co-ordination of ICS. IWPSR published their preliminary Industry Code of Practice on Ship Recycling (ICPSR) in August 2001 (Marisec, 2001).

The focus of ICPSR is on issues related to preparation of the ship for recycling, with a primary focus on hazardous materials onboard the ship and the registration and minimisation of the presence of these before delivery for recycling. Of the more tangible contents of ICPSR is an inventory of potentially hazardous materials on board a ship, consisting of two lists, which have later been included in the IMO guidelines.

The ICPSR has no statutory effects towards ship owners, but the industry organisations involved in the development of the code are committed to encourage the widespread use of it within the industry. The code of practise does not include a certification system or third party accreditation.

ICS leads the broadly based inter-industry working group on ship recycling. Their opinion is that some areas of the existing IMO Code on ship recycling should be made mandatory - for example, gas freeing of compartments prior to delivery at recycling yards and the maintenance of inventories of hazardous materials (green passports). Moreover the industry supports establishment of a system of approved recycling yards, demonstrating which facilities meet acceptable safety standards, to which reference can be made when negotiating the disposal of ships (ICS 2007).
5.5.2 Baltic and International Maritime Council, BIMCO

The Baltic and International Maritime Council (BIMCO) is the world’s largest private shipping organisation with its owner members controlling 65% of the world merchant fleet. BIMCO has recently released their policy on ship recycling (BIMCO 2007). This policy expresses that BIMCO believes that ship recycling is the most environmentally friendly way of disposing of ships and if properly handled BIMCO sees the ship recycling industry as a “green industry”.

BIMCO’s policy expresses the support to the implementation of a legally binding IMO instrument on ship recycling as the most appropriate solution for ship recycling issues, taking into consideration views of the Basel Convention and ILO.

BIMCO's policy further encourages the industry to use the DEMOLISHCON contract when selling ships for recycling. BIMCO's policy expresses the view that it is mainly for the authorities of the flag states to certify ships ready for recycling.

5.5.3 Intertanko

Intertanko is the International Association of Independent Tanker Owners. The organisation has 250 members, whose combined fleet comprises more than 2,500 tankers totalling 210 million DWT, which is 70% of the world's independent tanker fleet. Intertanko has in September 2006 announced the adoption of an "Interim Strategy", according to which ship owners should only use recycling facilities that have made demonstrable advances in terms of safety and environmental management requirements as established in Section C of the draft IMO Convention.

5.5.4 Private companies

An increasing number of private ship-owners are getting involved in the work on ensuring environmental sound and safe recycling of their ships. A number of companies have prepared inventories of hazardous materials in (some of) their existing ships and new-builds, green passports.

The list below includes ships for which green passports have been prepared. The list has been prepared from searches on the internet and other ready available data sources and is not expected to be comprehensive:

- 25 LNG Carriers managed by Shell International Trading and Shipping Company Ltd.
- Aida (Car Carrier, Wallenius Lines)
- Arctic Discoverer (LNG Carrier, K-Line)
- One existing vessel in every class every year (BP Shipping)
- 3 Container ships (Maersk Line Ltd.)
- 3 P-Max Tankers (Concordia Maritime)
• Stena Seatrader (Ro-Pax, Stena Lines).

Regarding ship recycling BP Shipping has developed standards of its own for ship recycling that include the removal of as much hazardous material as possible from vessels before recycling and auditing recycling facilities using BP group health, safety and environmental criteria. BP Shipping auditors normally witness the recycling process and view the conditions of the facility prior to their use as well as visiting secondary locations such as asbestos disposal sites. All recycling facilities are audited at least every three years. When necessary, as in the recycling of four BP Shipping tankers in Spain in 2004, a BP Shipping Shipyard Health Safety and Environment Superintendent oversees the actual deconstruction of a vessel (BP Shipping 2006).

The shipping company P&O Nedlloyd (now part of Maersk Line) have taken another approach in forming a partnership with two Chinese ship scrapping facilities whose environmental and safety standards were upgraded via technical assistance and training. The partnership includes an agreement on scrapping of the companies’ ships against common agreed HSE-standards and procedures.

P&O Nedlloyd initially scrapped 19 ships at these two Chinese facilities in 2000-2003 and now as a part of the Maersk Line continues to use one of the facilities for their recycling demand.

Proposals for new procedures and policies leading to safer dismantling are in particular part of the work of the EU financed project SHIPDISMANTL, but also the SAFETOW and SHIPMATES studies address related technical issues. Improvements and procedures have also been published in the technical literature for Turkey (Neser et al 2006) and South Asia (Wijngaarden 2006).
6  End-of-life ships: hazardous waste or pre-cleaned?

6.1  Introduction

In international waste shipment law it is recognized that a ship may become waste as defined in Article 2 of the Basel Convention and that at the same time it may be defined as a ship under other international rules.34

The definition of waste in European Community law also applies to ships sent for dismantling. According to the law waste means any substance or object in the categories set out in Annex I to the Waste Framework Directive35 which the holder discards or intends or is required to discard.

If a vessel contains considerable quantities of hazardous substances, or in the words of the relevant waste entry GC 030, has not been "properly emptied" of hazardous materials, it will be considered as hazardous waste. The export of such a vessel for scrapping from the EC to a non-OECD country is prohibited under the Basel Ban amendment and the Waste Shipment Regulation, and any dismantling must take place under safe and environmentally sound conditions in an OECD country.

The alternative is to have the ship decontaminated (pre-cleaned) in such a way that the ship no longer constitutes a hazardous waste. This legal interpretation was confirmed by the French *Conseil d'Etat* in the case of the former aircraft carrier *Clemenceau*.36

Ships are thus pursuant to Annex II of the Waste Shipment Regulation considered non-hazardous if they fall under the entry GC 030 ‘vessels and other floating structures for breaking up, properly emptied of any cargo and other materi-

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36  Decision of 15 February 2006, No 288801-288811, see: http://www.conseil-etat.fr/cc/jurispd/index_ac_id0607.shtml
als arising from the operation of the vessel, which may have been classified as
dangerous substance or waste’.

What the term “properly emptied” means is not precisely defined in the Com-


munity Regulation. We are in the following assessing both legally and techni-

cally how the regulation term "properly emptied" may be interpreted, both in

relation to cargo and other materials arising from operation of the ship as well

as hazardous materials in the ship's structure and equipment.

6.2 Community law on hazardous waste

Under Community legislation hazardous waste is defined as “wastes featuring

on a list to be drawn up in accordance with procedures laid down in Directive

75/442/EEC on the basis of Annexes I and II of Directive 91/689/EEC.” These

wastes must have one or more of the properties listed in Annex III of the same

Directive.

The most recent version of that list of hazardous waste is included in Commis-

sion Decision 2000/532/EC as last amended by Council Decision 2001/573/EC.

Ships often contain hazardous materials, which can endanger the environment,

if they are not managed in an environmentally sound way. These hazardous ma-

terials are listed as hazardous entries in the EU waste list as included in Com-

mission Decision 2000/532/EC as amended.

Annex V of the Waste Shipment Regulation is relevant when determining if a

shipment of waste is subject to the ban in Article 16 of the Waste Shipment

Regulation. Article 16 of the Regulation bans waste listed in Annex V if des-

tined for recovery in countries to which the OECD decision does not apply.

In Annex V the following hazardous entries relevant for ships destined for dis-

mantling can be found in Part 1, list A.

Table 6-1 below contains substances, which are likely to be found in relatively

large amounts in ships for scrapping, and which is hazardous according to the

above mentioned regulation. The substances in the table is based on the list of

hazardous materials most often found in vessels prepared by the ICS as part of

their 2001 ship recycling guidelines /ICS 2001/. The table includes information

of the hazardous properties of the compounds and if such exist, concentration

limits for the hazardous compound. Further information on the Basel conven-

tion classification is included. A more comprehensive list of compounds is

found in appendix D.

Based on the data in Table 6-1, it can be observed that the concentration limits

for hazardous materials ranges from 0.1% (1 g/kg) for e.g. asbestos to 3% (30

g/kg) for e.g. tin in tin based anti-fouling coating. PCB has an exceptionally

low limit of 50 mg/kg equal to 0.05‰. For a number of substances concentra-

tion limits do not exist, e.g. substances dangerous to the environment.
The EU hazardous waste classification requires that the sum of the relative concentrations of hazardous substances compared to the concentration limits should be less than 100%. Unfortunately, as mentioned above, concentration limits do not exist for several of the hazardous waste fractions which are present in relatively large quantities in ships, e.g. oil emulsions and other oil containing wastes.
Table 6-1  Different types of hazardous waste to be identified at ships, classification of properties and their concentration limits in a relevant entity.

<table>
<thead>
<tr>
<th>Substance</th>
<th>Classification of hazardous properties according to EU Hazardous Waste Classification</th>
<th>Description of concentration limits for hazardous waste</th>
<th>Basel Convention Hazard Class, Annex III</th>
<th>Basel Convention, Annex VIII</th>
</tr>
</thead>
<tbody>
<tr>
<td>Halons</td>
<td>Depends on the type of halons: Carbontetrachloride: T, Carc3 Methylchioride: Fx</td>
<td>Yes if conc. &gt; 3 %</td>
<td>H2</td>
<td></td>
</tr>
<tr>
<td>Refrigerants such as R22/R12</td>
<td>Regulated according to Regulation 2037/2000</td>
<td></td>
<td>H2</td>
<td></td>
</tr>
<tr>
<td>Fuel oil, diesel oil and gas oil</td>
<td>Carc. 3</td>
<td>Yes of conc.&gt;1 %</td>
<td>H3</td>
<td></td>
</tr>
<tr>
<td>Radioactive materials</td>
<td>Radioactive</td>
<td>Dependent on the type of radioactive material</td>
<td>H7</td>
<td></td>
</tr>
<tr>
<td>Waste lead acid batteries</td>
<td>C (R35)</td>
<td>Yes if con. &gt; 1 %</td>
<td>H8</td>
<td>A1160</td>
</tr>
<tr>
<td>Asbestos</td>
<td>Carc1</td>
<td>Yes if con. &gt; 0.1 %</td>
<td>H11</td>
<td>A2050</td>
</tr>
<tr>
<td>PCB and PCT containing substances</td>
<td>Dangerous to the environment</td>
<td>Yes, if con. &gt; 0.005 %</td>
<td>H11</td>
<td>A3180</td>
</tr>
<tr>
<td>Tin based anti-fouling coatings</td>
<td>Toxic and dangerous to the environment</td>
<td>T: if conc.&gt; 3%</td>
<td>H12</td>
<td>A4030</td>
</tr>
<tr>
<td>Lubricating oils</td>
<td>Dependent on the type of oil but mainly Carc 2</td>
<td>Yes if conc. &gt;0.1 %</td>
<td>H12</td>
<td>A3020, A4060</td>
</tr>
<tr>
<td>Hydraulic Oils</td>
<td>Dependent on the type of oil but may be dangerous to the environment</td>
<td>No concentration limits</td>
<td>H12</td>
<td>A3020, A4060</td>
</tr>
<tr>
<td>Oil residues (sludge), oil water mixtures, waste oils, oil cont. waste</td>
<td>Dependent on the type of oil but may be dangerous to the environment</td>
<td>No concentration limits</td>
<td>H 12</td>
<td></td>
</tr>
<tr>
<td>Polyvinyl Chloride</td>
<td>None</td>
<td>Not hazardous waste</td>
<td>H13</td>
<td></td>
</tr>
</tbody>
</table>
6.3 Pre-cleaning

The pre-cleaning concept essentially means removal of hazardous materials in the EU and consecutive shipping of the cleaned vessel to a ship scrapping location elsewhere, e.g. in Asia or Turkey. It has been proposed and discussed as a means of solving the EHS issues in the ship scrapping business. This concept would result in the hazardous materials being removed in Europe, where technologies and facilities for safe removal and treatment of the hazardous materials exist and at the same time allow the major part of the work intensive ship breaking to be performed in Asia, where the labour costs are much lower than in Europe.

The feasibility of the pre-cleaning concept has however been questioned from various sides, both from a technical, safety and economic angle. Some of the arguments against the concept are related to the fact that the pre-cleaning concept includes towing, as gradually removal of hazardous materials from a ship at one point will make the remaining structure not ship-shape (unable to sail for own power). Removal of materials from the ship beyond this point will result in the ship's having to be towed when transported from Europe to Asia.

The core of the feasibility discussion can be synthesized into the following scenarios and their internal location on the "pre-cleaning ladder" as illustrated in Figure 6-1 below:

- Pre-cleaning to a content where the ship is still ship-shape (self-propelled)
- Pre-cleaning to a content satisfying the "proper and necessary cleaning measures" of the EU waste law
- Pre-cleaning to totally remove all hazardous materials in the ship.
6.3.1 “Ship-shape” condition

Ships have to fulfil the current safety requirements to be issued with proper certificates to be allowed to sail under their own power. The SOLAS Convention (IMO 1974) is generally regarded as the most important of all international treaties concerning the safety of merchant ships.

The SOLAS Convention specifies minimum standards for the construction, equipment and operation of ships, compatible with their safety. Flag States are responsible for ensuring that ships under their flag comply with its requirements, and a number of certificates are prescribed in the Convention as proof that this has been done. Control provisions also allow Contracting Governments to inspect ships of other Contracting States if there are clear grounds for believing that the ship and its equipment do not substantially comply with the requirements of the Convention - this procedure is known as port State control.

Examples of the safety requirements in the Convention:

- subdivision of passenger ships into watertight compartments must be such that after assumed damage to the ship's hull the vessel will remain afloat and stable;
- watertight integrity and bilge pumping arrangements for passenger ships;
- stability requirements for both passenger and cargo ships;
Fire safety provisions for all ships and specific measures for passenger ships, cargo ships and tankers, including among others:
- requirements for division of the ship into main and vertical zones by thermal and structural boundaries;
- separation of accommodation spaces from the remainder of the ship by thermal and structural boundaries;
- restricted use of combustible materials;
- ready availability of fire-extinguishing appliances.

How many hazardous materials can be removed from a ship while still keeping it in a ship-shape condition depends on the actual case.

It will in general be possible to replace one hazardous material/component with another non-hazardous material/component with the same function. This could in theory mean replacing fire-retardant asbestos with another non-hazardous fire-retardant material, e.g. glass wool. It will however not be possible to replace fire-retardant material with fire-fighting equipment (EMSA 2007).

Special cases exist where it is possible to change the status of a ship, e.g. a passenger ship changing status to for instance cargo ship before the last journey. For this it will be possible to pre-clean for instance the passenger sections of the ship, e.g. remove the fire-retarding asbestos from the passenger cabins and close off these sections (EMSA 2007).

An often discussed waste fraction in relation to pre-cleaning is paint. As long as paint has no safety function like for instance fire-retarding paint, it can be removed and still keep the ship in ship-shape condition. This includes paint on the outside hull, but also antifouling paint under the waterline.

Pre-cleaning of a ship to a level where it is still ship-shape will in most cases not be sufficient to meet the EU waste shipment law's requirement of "properly emptied". This can most easily be seen from the fact that oil, including bunker oil, has to be removed from the ship, which renders the ship unable to sail under its own power.

### 6.3.2 Towing

Whenever material or components have been removed from a ship, which have made it unable to meet the safety requirements discussed above, the pre-cleaned ship will have to be towed to the final breaking location.

No international guidelines exist for approving ships for tow. Such ships need to be approved by a recognised classification society who checks the safety conditions of the ship in relation to the proposed tow (EMSA 2007).

E.g. in Denmark the following requirements need to be fulfilled by the pre-cleaned ship (similar requirements exist internationally):

- Fulfilment of load line (stability calculations/test);
- Mounting of towing arrangements, including spare arrangements;
• Mounting of appropriate lanterns.

From a technical point of view almost all material/components can be removed from a ship while still keeping it in a towable condition as long as parts of the primary ship structure are not removed. This means for instance that the main deck cannot be removed (EMSA 2007).

Towing of pre-cleaned ships will be associated with a different risk-pattern than sailing of ships for its own power. This different risk-pattern is described and quantified at the end of the Chapter.

In cases where no hazardous materials are located inside the primary structure of the ship, a total removal of all hazardous materials is possible.

Between the two extremes, the ship as it is today and the totally pre-cleaned ship, are several intermediate situations, including the situation of removing as much as possible of the hazardous materials in order to fulfil the "properly emptied" requirement of EU waste law.

6.3.3 "Properly emptied"

Based on the data in Table 6-1, it can be observed that EU waste law includes concentrations ranging from 0.1% (1 g/kg) for e.g. asbestos to 3% (30 g/kg) for e.g. tin based anti-fouling coating. PCB has an exceptionally low limit of 50 mg/kg equal to 0.05‰. For a number of substances concentration limits do not exist, including substances dangerous to the environment.

For compounds where concentration limits exist EU waste law does not specify what material fraction the hazardous compounds shall be seen in relation to. This is important information in order to be able to calculate the concentration of the compound in the material fraction and from that evaluate if it is to be considered as hazardous waste.

The problem can be illustrated by considering a ship of comparable size (15,432 LDT) to the one used in the economic case analysis in chapter 8. If this ship itself as a whole has to be classified as hazardous waste based on the total amount of asbestos or the total amount of tin-based anti-fouling coating, the total amount has to be above 15.4 tons or 463 tons, respectively. These amounts of the two compounds are required to bring the total concentrations above the concentration limits to classify the waste as hazardous.

The above example clearly shows that the volume of hazardous materials should not be evaluated against the total ship weight. Instead it is appropriate to evaluate the amount of hazardous material against the smallest material fraction, which can be taken out of the ship as a separate fraction. Such smallest separate material fractions have to be decided on a case-by-case basis. Examples could include:

• The total exterior paint layer on the outside of the ship hull (could consist of several different paint layers, but such cannot be separated);
• Total wall panels containing asbestos;
• The PCB-containing oil in transformers (not the total weight of the transformer).

For compounds where no concentration limit exists, the smallest separate material fraction containing the hazardous compound must be removed as hazardous waste.

From a practical point of view a maximum allowable threshold concentration limit should be defined for compounds where no concentration limits exist. The limit could for instance be relevant in a case where for instance oil tanks are emptied of oil, but these still contain traces of oil. Such limit could be defined at 0.1%, which is the concentration limit for the most dangerous compounds (except for PCB, where the concentration limit is 0.05 ‰).

6.3.4 Technical feasibility

As stated in Section 6.3.2, the theoretical upper limit for pre-cleaning of vessels consists in removing parts of the primary vessel structure, as this will leave the remaining structure unfit for towing.

In practice a lower limit for pre-cleaning will exist, where pre-cleaning above this limit most likely will be unfeasible. The "location" of this practical limit for pre-cleaning will have to be established on a case-by-case basis, but some general considerations on the location can be established. The feasibility of pre-cleaning will be reduced whenever planning for removal of difficult accessible hazardous materials, which will include breaking-up of other non-hazardous structures to get access to the hazardous materials for removal. The more of these operations have to be done to pre-clean the vessel under consideration, the closer one comes to the limit where it will be easier for the ship owner to break-up the entire structure at the "pre-cleaning facility".

A more pronounced case of these unfeasible pre-cleaning measures are measures that involve breaking-up of structures on the vessel that will have to be replaced afterwards to enable the remaining vessel to be in a towable condition. Such measures will be costly and reduce the feasibility of pre-cleaning of the vessel quite fast.

Pre-cleaning measures that result in replacement of other structures include: removal of large structures from the inner sections of the vessel, which will result in the need for cutting holes in the outer structures that will have to be closed again afterwards, and removal of structures that stabilise other structures which also have to be removed. The main engine is an example of a large structure that most likely will be unfeasible to remove. A lower deck supporting or stabilising upper decks is another example of a structure which will be unfeasible to remove from a stability/structural point of view.

The location of this practical feasibility level for pre-cleaning on the "pre-cleaning ladder" has to be decided on a case-to-case basis. Asbestos has often
been used for fire sectioning structures including decks, which is why a location below the "properly emptied" level is expected to be rather common.

Another technical issue that is affecting the feasibility of the pre-cleaning concept is the availability of appropriate towing vessels. Based on the projection of future scrapping requirement, Chapter 2, an estimate of up to 200 pre-cleaned vessels a year, to be towed from Europe, can be considered. If all these vessels have to be towed to Asia, it will require around 66 tug-vessels working full-time (based on an estimated duration of a round-trip of 120 days including mobilisation time etc., see following Chapter).

Such tug demand will result in temporary shortage of tugs, until the demand has been met by the supply of new tugs.

6.4 Existing pre-cleaning guidelines

Other organisations or governments have developed guidelines for pre-cleaning of ships. These guidelines are not developed to cover scrapping of ships, but can provide input to the discussion of appropriate cleaning measures. Some of these guidelines are described below.

6.4.1 US artificial reefing of vessels
The US Code of Federal Regulations, Title 40, Volume 12, Parts 190 to 259 as revised July 1, 1996, permits in section 229.1 the burial at sea of vessels and airplanes registered in the United States or flying the United States flag under certain conditions, including:

"appropriate measures shall be taken, prior to disposal, by qualified personnel to remove to the maximum extent practicable all materials which may degrade the marine environment, including without limitation:

(i) emptying of all fuel lines and fuel tanks to the lowest point practicable, flushing of such lines and tanks with water, and again emptying such lines and tanks to the lowest point practicable so that such lines and tanks are essentially free of petroleum, and
(ii) removing from the hulls other pollutants and all readily detachable material capable of creating debris or contributing to chemical pollution".

The clean-up goals are further specified in Table 6-2.
Table 6-2  US Artificial Reefing of Vessels Narrative Clean-up Goals for Materials of Concern

<table>
<thead>
<tr>
<th>Material of Concern</th>
<th>Narrative Clean-up goal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oil and fuel</td>
<td>Remove liquid fuels and oils and semi-solids (greases) so that: no visible sheen is remaining on the tank surfaces (this includes all interior fittings, piping, structural members); no film or visible accumulation is remaining on any vessel structure or component (e.g., on machinery or from spills on decking or carpet). The end result of such clean-up should be that no sheen be visible upon sinking a vessel.</td>
</tr>
<tr>
<td>Asbestos</td>
<td>Remove any loose asbestos and asbestos that may become loose during vessel sinking; remove or seal accessible friable asbestos.</td>
</tr>
<tr>
<td>Polychlorinated Biphenyls (PCBs)</td>
<td>Remove all manufactured products containing greater than or equal to (≥) 50 parts per million (ppm) of solid PCBs; remove all liquid PCBs regardless of concentration; remove all materials contaminated by PCB spills where the concentration of the original PCB source is ≥ 50 ppm.</td>
</tr>
<tr>
<td>Paint</td>
<td>Remove harmful exterior hull anti-fouling systems that are determined to be active; remove exfoliating (peeling) and exfoliated paint.</td>
</tr>
<tr>
<td>Solids/debris/floatables</td>
<td>Remove loose debris, including materials or equipment that is not permanently attached to the vessel that could be transported into the water column during a sinking event.</td>
</tr>
<tr>
<td>Other materials of environmental concern</td>
<td>Remove other materials that may negatively impact the biological, physical, or chemical characteristics of the marine environment.</td>
</tr>
</tbody>
</table>

6.4.2  OSPAR Artificial Reefs Guidelines

The Oslo Paris Convention for protection of the North Atlantic (OSPAR) has also developed guidelines on artificial reefs within their territory.

These guidelines specify that artificial reefs should only be established if, after due consideration of all socio-economic and environmental costs (e.g. undesirable impacts or alteration), a net benefit can be demonstrated, in relation to the defined objectives. In such assessment of potential effects (which may have to be a formal environmental impact assessment if major impacts cannot be ruled out) the following steps should be followed:
• Studies should be carried out that yield the information required to assess:
  - possible impacts of the installation of an artificial reef on the indigenous fauna and flora and the environment of the site and the wider surroundings;

In relation to the requirements for the materials for use as artificial reefs the OSPAR Guidelines specify:

• Artificial reefs should be built from inert materials. For the purpose of these guidelines, inert materials are those which do not cause pollution through leaching, physical or chemical weathering and/or biological activity. Physical or chemical weathering of structures may result in increased exposures for sensitive organisms to contaminants and lead to adverse environmental effects.

• Materials used for the construction of permanent artificial reefs will of necessity be bulky in nature, for example geological material (i.e. rock), concrete or steel.

• No materials should be used for the construction of artificial reefs which constitute wastes or other matter whose disposal at sea is otherwise prohibited.

The Governments of France and the United Kingdom have developed guidelines to comply with the OSPAR recommendations for cleaning of vessels to be used as shooting targets or for artificial reefs.

### 6.5 Risk assessment of towing of pre-cleaned ships from Europe to Asia

As described earlier in this Chapter, pre-cleaning of ships is closely connected to towing as the pre-cleaned remaining structure often will be in a shape unfit for sailing under its own power and which then has to be towed from the pre-cleaning location to the final scrapping location.

The objective of this section is to assess the risks of towing of pre-cleaned ships from Europe to Asia. To meet the objective, a quantitative assessment has been made of the risk of total loss of a towed ship in connection with towing it from London in England to Alang in India. Two routes are considered, one through the Suez Canal and another around the Cape of Good Hope, as shown in Figure 6-3 and 6-4. The routes are defined from the "portworld" web site (http://www.portworld.com/). The two locations have been chosen as representatives of a European port and a major Asian scrapping location, respectively. Changes to departure harbours within Europe and destinations within Asia will affect the results only marginally.

The risk of fatalities in connection with a towing accident is also assessed.
6.5.1 Risk assessment

Towing of ships
Towing is a routine operation for tugs. Good practice of seamanship is necessary to accomplish the mission without endangering the tow, tug, personnel, or operational schedules. While nearly all transoceanic and coastal tows are completed uneventfully, emergency conditions must be expected. Proper preparations must be made for emergency conditions. Good planning, preparation for emergency situations and correct ship handling are necessary elements of towing.

Special towing missions generally transit unprotected coastal waters and the open ocean. These missions require considerably larger and stronger tugs using
heavier and stronger towing gear to withstand the violent stresses encountered in open coastal and ocean seas. Normally, these tugs have greater towing power (larger engines and overall heavier equipment and construction) and are equipped with towing machinery, such as single- and double-drum wire rope towing winches; tow wire guides, rollers, and pinions; cranes or winch/boom assemblies to handle the tow rigging; and a small workboat for boarding and inspecting the tow while en route. Towing gear for these missions include heavy chain bridles and pendants (anchor chain), plate shackles, retrieving wires, emergency towing bridles, towlines (hawsers), flooding alarms, pumps, and anchors.

**Towing responsibilities**

The command requesting tow of craft must provide the craft in seaworthy condition with flooding alarms, navigation lights, electrical power for alarms and lights, salvage gear (anchors and pumps), and towing gear (bridle, pendant, and retrieving wires). For suspect or deficient seaworthiness conditions, both the tow and towing command must agree on the risk of tow.

The command accepting the tow must provide tug and towing gear to connect to the towed craft's towing gear. The tug and gear must be seaworthy for the particular mission route and have the appropriate size, horsepower, and control to safely and successfully accomplish the towing mission. On accepting the tow, the towing command accepts full responsibility. Before accepting, seaworthiness must be verified. The tow should be refused if it is considered not fit for sea. Towing is accepted only after the tug's officers completed a comprehensive evaluation and survey of the tow.

**Seaworthiness**

Towing seaworthiness means suitable condition for the mission. This concerns all the various technical implications of the tow and towing vessel, including:-

- Vessel design and specifications.
- Structural condition and stability.
- Age, maintenance history, and status.
- Reinforcement requirements.
- Hull and superstructure closures.
- Adequacy of towing gear.
- Dewatering facilities.
- Chafing gear.
- Fire fighting and damage control facilities.
- Repair parts.
- Tow-boarding facilities.
- Emergency towing gear.
- Waters to be transited.
- Hazards of the route.
A certificate of seaworthiness for ocean tows must be completed. The certificate indicates the general characteristics of the tow, type of cargo, towing gear, lights, and emergency gear aboard the tow.

**Categories of risk**

Commanding officers of the towing ship and the towed craft should agree to the conditions of risk in towing the craft. Risk conditions are based on the seaworthiness and structural condition of the tow, expected sea and weather conditions for the route, and the specifications of the towing ship.

In summary, foreseeable hazards are as a rule considered by the commanding officers in advance and suitable precautionary measures are taken to reduce the occurrence of accidental events during the voyage.

Accidental events can still occur in spite of precautions because of the inherent risky nature of the towing operation. A certain marginal risk cannot be completely eliminated for various reasons. The main reasons are the weather conditions, hidden faults in ship, tug and gear and not at least human errors.

Such marginal risk is difficult to model in detail and it is according necessary to model it "on average" by using statistics of accidents that have occurred in the past. Statistics for oceanic towing accidents have not been available and statistics for normal ship operation have been used. This is considered as a good approximation as in both cases the main risk contribution is the rate of occurrence of human errors. The risk estimate is given in the next sub-section.

**Methodology and basis for risk assessment**

The methodology and basis for the risk assessment is described below.

The risk of occurrence of towing accidents is dominated by human errors as is the case for ship accidents in general. This is documented by statistics from U.S. Coast Guard shown in Table 6-3.

**Table 6-3 Human error contribution to various types of accidents, ref Dr. Anita Rothblum, Human Error and Marine Safety, U.S. Coast Guard, Research and Development Center, 2003**

<table>
<thead>
<tr>
<th>Type of Accident</th>
<th>Human Error Contribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tanker accidents</td>
<td>84 - 88%</td>
</tr>
<tr>
<td>Towing vessel groundings</td>
<td>79%</td>
</tr>
<tr>
<td>Collisions</td>
<td>89 - 96%</td>
</tr>
<tr>
<td>Allisions</td>
<td>75%</td>
</tr>
<tr>
<td>Fire and explosions</td>
<td>75%</td>
</tr>
</tbody>
</table>
A search in published papers, (e.g. Journal of Navigation) and on the internet has indicated that available statistical models and data for ship accidents do not cover towing accidents.

As towing accident models are not available and as towing accidents are dominated by human errors as ship accidents are, accident models and data for ship accidents are used to predict the frequency of accidents under towing of ships from Europe to Asia.

The generic simplified ship accident model used is as follows:

accident rate per ship mile x ship miles

This simplistic model describes the situation in general. It has been developed by dividing the number of accidents with the number miles sailed for certain area over certain periods of time.

The generic accident rates are given Table 6-4. All the mentioned types of accidents are included in the risk estimate given in Table 6-5.

<table>
<thead>
<tr>
<th>Type of Accident</th>
<th>Generic accident rate per ship-mile</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collision</td>
<td>$5.0 \times 10^{-7}$</td>
</tr>
<tr>
<td>Grounding</td>
<td>$7.2 \times 10^{-7}$</td>
</tr>
<tr>
<td>Fire/explosion</td>
<td>$1.0 \times 10^{-8}$</td>
</tr>
<tr>
<td>Hull damage</td>
<td>$1.6 \times 10^{-8}$</td>
</tr>
</tbody>
</table>

The accident rate for collisions, for example, means that 5 accidents may be expected for every 10 million sailed nautical miles.

The inherent risk in towing of vessels is in general larger than if the vessels are self-propelled because the complexity in towing is greater, i.e. there are more hazards in towing that in normal sailing. The additional hazards may come from handling of the towing arrangements, communication between the tug and the towed vessel, more severe weather restrictions, low quality towing companies undercutting the price etc. A risk increase factor is applied here to account for the additional hazards.

The risk increase factor has been evaluated by two methods:

- increased insurance premium for towing of a ship compared to when it is self-propelled;
- guideline for ship collision with bridges by both self-propelled ships and ships under tow.
The additional yearly insurance premium for towing a ship from Europe to India expresses the insurance company’s assessed extra risk compared to normal self-propelled sailing. This additional yearly premium has been estimated at 8.5% by a marine insurance company. This gives an average 60% increase for the duration of towing that has been estimated at 60 days. It has not been possible to distinguish between the two routes.

The American State Highway Organisation has developed a standard and guideline for assessment of the risk of vessel collision with highway bridges. (AASHTO LFRD Standard). In the standard, the generic probability of mismanoeuvre at bridge passage is a factor 2 larger for towed barges than for ordinary ships.

The two estimates are considered in agreement for the present purpose and a risk increase factor of 1.6, equal to an increased risk of 60%, is applied on the accident probabilities to give the results in Table 6-4.

Furthermore, the risk estimate is based on the following data:

- The distance London - Alang through Suez is estimated at 6265 nautical miles according to Portworld.
- The distance London - Alang around Cape is estimated at 10,810 nautical miles according to Portworld.
- An average towing speed of 5 knot is used.

### 6.5.2 Results

The results of the risk assessment are given in Table 6-5. The main result is that occurrence of a total loss of the towed vessel has a probability of 0.012% for a voyage through the Suez Canal and 0.022% for a voyage around the Cape of Good Hope. This can also be expressed as one loss is expected in 8,006 towing voyages through the Suez Canal and in 4,640 towing voyages around the Cape of Good Hope. The difference in the risk is mainly due to the different lengths of the two routes.

<table>
<thead>
<tr>
<th></th>
<th>London - Alang via Suez Canal</th>
<th>London - Alang via Cape of Good Hope</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Probability Number</td>
<td>Probability Percent</td>
</tr>
<tr>
<td>Factor</td>
<td>10000</td>
<td>1</td>
</tr>
<tr>
<td>Accident</td>
<td>124.9</td>
<td>1.249%</td>
</tr>
<tr>
<td>Total loss</td>
<td>1.2</td>
<td>0.012%</td>
</tr>
<tr>
<td>Fatalities</td>
<td>8.3</td>
<td>0.083%</td>
</tr>
</tbody>
</table>

Table 6-5 Risk per towing voyage London, UK - Alang, India
Although not the favoured mode of propulsion the towing of vessels for scrap is not uncommon. The Liberty ships bought by Able in the USA were towed to the United Kingdom across the Atlantic, and more recently the ex-cruise liner Blue Lady (ex Norway, ex SS France) was towed around the Cape in 2005 for beaching in Alang, India.

6.6 Conclusion on pre-cleaning

The appropriate cleaning measures according to EU waste laws are described above. This means a ship is properly emptied if it does not contain:

- Material fractions with a content of hazardous materials above the concentration making the material a hazardous waste. The relevant material fractions are the smallest fraction that can be taken out separately off the ship. These have to be decided on a case-by-case basis.

The necessary cleaning measures will in many cases leave the remaining ship structure in a shape which is unfit for sailing under its own power and which then will have to be towed to the final scrapping location. The risks of towing pre-cleaned ships from Europe to Asia have been evaluated. The result is that towing adds to the risk of transporting the ship by up to a factor of around two, compared to the case where the ship sails the same route under its own power.

Some additional/concluding recommendations regarding pre-cleaning measures can be added:

Main machines and other large interior structures will most likely be unfeasible to remove as part of the pre-cleaning. This also goes for entire decks or parts of decks or other structures that support other larger structures within the vessel.

Special waste fractions such as halons and refrigerants are regulated by Council Regulation 2037/2000/EC and it is recommended to remove all refrigerants from the cooling systems. Additionally, fire extinguishers may be removed from the ship and transferred to a proper hazardous waste treatment facility.

It is recommended to remove all batteries, even though the alkaline batteries are of no harm. Various studies have shown that non-experience persons are not capable of sorting the various types of batteries into hazardous and non-hazardous batteries.

All WEEE such as navigation equipment, fluorescent tubes and equipment containing cathode ray tubes should be removed as separate and intact fractions from the ship. In the EU, Directive 2002/96/EC sets up requirements for the handling and treatment of the different types of WEEE.

It is not recommended to remove any other heavy metal containing waste as these are alloys located in switches and other smaller units.
Even though PVC and neoprene are non-hazardous wastes, they have been included in the list as regulated by the Basel Convention. Additionally, incineration of plastic containing high quantities of chlorine may result in large quantities of flue gas cleaning products. The uncontrolled combustion of plastic which often occurs in developing countries should be prevented as far as possible, e.g. by removing the waste prior to towing the ship for dismantling.

After removal of the hazardous substances/waste, the waste must be transferred to a treatment facility for hazardous waste approved by the national authorities.

Partial pre-cleaning to a level where a vessel can still travel self-propelled is not foreseen as such in IMO Regulations. SOLAS (art. 4) does allow for exemptions for a single journey, which the final voyage to a scrap yard must be said to be, but it is not likely that this exemption can be applied generally to all the vessels destined for recycling.
7 Costs of ship dismantling and pre-cleaning of ships

This section presents an analysis of the costs and benefits of ship dismantling and pre-cleaning of ships. The objective has been to derive the additional costs of pre-cleaning and dismantling of ships applying sound environmental and safety standards, thus making it possible to compare the environmental advantages with the short-term economic disadvantages of pre-cleaning and ship dismantling at "green" facilities.

7.1 Introduction

The present approaches to green recycling are more expensive than the conventional beach breaking. The extra cost of performing green recycling is related to a demand for infrastructure (drainable surfaces, cranes etc.), and to each of the extra processes involved in green recycling, including:

- Construction costs for new equipment, machinery and infrastructure;
- Manpower costs for new and more time consuming work routines;
- Hazardous waste disposal costs.

Dismantling of ships is time-consuming and labour-intensive. The time used for performing cleaning of vessels between 10,000 and 25,000 LDT was found to range from 4 to 7 weeks (COWI/DG TREN, 2004). Therefore the cost of labour plays a very important role for the overall economics of ship breaking.

Ship owners generally receive positive cash flow from the demolition market when selling ships for demolition\(^{37}\). The ship owner will typically sell the ship for demolition to the ship breaking facility associated with the highest net profit. Here the price offered by the ship breaker is most important, but transaction costs might also play a role. The total price of the vessel offered by a ship breaker is determined by a number of site specific factors such as steel prices, investment costs, labour costs, health and safety requirements, taxes and levies etc.

\(^{37}\)This has historically been the case when applying the conventional pier breaking or beaching methods.
7.2 Approach

The approach for analysing the costs and benefits of ship dismantling and pre-cleaning of ships is described below. This includes a description of scenarios and effects included in the analysis.

Scenarios

The analysis of costs and benefits is carried out from a ship owner perspective (EU located) considering the following scenarios:

1. **Reference scenario.** A business as usual scenario in which the ship owner will sell the vessel for scrapping in Asia where the conventional beach breaking method will be applied.\(^{38}\)

2. **Pre-cleaning scenario.** Pre-cleaning of ships in EU and Candidate countries and final dismantling at beaching sites in developing countries (Asia).

3. **Full "green" dismantling in EU scenario.** Dismantling of ships at a "green" facility in EU complying with applicable EU law and therefore also with the developed recycling guidelines under a new convention.

4. **Full "green" dismantling in OECD scenario.** Dismantling of ships at a "green" facility in an OECD country (represented by Turkey) complying fully with the developed recycling guidelines under a new convention.

Pre-cleaning of vessels destined for scrapping consists of removal of the contaminant and hazardous materials. The objective is to neutralise the vessel in such a way that its dismantling in existing capability, ideally, would not create environmental problems. This requires that the vessel to be stripped of environmentally hazardous materials such as asbestos, fuel oil, lead, PVC, PCBs and more.

A pre-cleaned ship is a hulk, a “dead” ship without power systems. The vessel will need to be transported to the scrapping facility under tow. The costs of towing will impose an expense and would have to be accounted for in the overall economic analyses. Furthermore, towing is an operation that involves an increased risk of accidents that may for example lead to loss of ship.

The scenarios analysed are illustrated in the table below and split into EU and non-EU according to the existing conditions for the reference scenario and the applicability of the EU Waste Shipment Regulation for the future scenarios.

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\(^{38}\) Represents the situation where the ship owner's decision on when and where to scrap are not subject to any constraints. The ship owner will simply choose to scrap at the ship breaking yard offering the highest price.
The table illustrates where cleaning and breaking takes place in the various scenarios. Obviously, cleaning may be performed as an activity separated from the breaking or performed in relation and coincident with the breaking of the ship.

The table shows that there are three alternatives to the reference scenario which have been analysed. The results of these scenarios are compared with the results of the reference scenario.

The calculation of costs and benefits is restricted to these scenarios. On this basis the consequences of other cleaning and dismantling scenarios are discussed.

Pre-cleaning level
In chapter 6, theoretically three different levels of pre-cleaning could be relevant:

1. To the extent which still just allow the ship to sail by itself (self propelled);
2. To the extent which allows export of the vessel under the existing EC Waste Shipment regulation, i.e. “properly emptied”;
3. To the extent where the ship is completely emptied of hazardous materials.

As earlier described, level 1 would not meet WSR requirements and level 3 is not a practically achievable level. In this section on economics it is level 2 of pre-cleaning that is considered in relation to analysing the costs and benefits of ship dismantling.

The time and resources needed to clean and dismantle a ship depends on the type of ship. Ideally the analysis should be carried out to reflect the consequences for all the different types of vessels. However, it is not possible to carry out detailed analysis for all types. It is presumed that a tanker is a good

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Distinguishing between 2 and 3 is mostly an academic exercise when ships are not exempted from the WSR. If ships are exempted the vessels will be allowed to destinations based on equivalent level of control, i.e. disposal facilities must comply with appropriate (EU or international) standards. 1, 2 and 3 can theoretically also be the same.

---
representative for the different ship types. Therefore the calculation of costs and benefits is carried out for a medium sized tanker.

Costs differences between different types and different sizes of ships must be expected. Based on the analyses of the consequences for a tanker it is discussed how to dismantle other types of vessels (i.e. passenger ships, naval ships etc.) which influences the results of the different scenarios respectively.

Effects

The aim has been to estimate the costs of dismantling (or net profit as a vessel often represents a value for the ship owner) per LDT for each scenario thus making it possible to estimate the additional costs of safe and environmentally sound ship recycling.

The table below lists the effects which have been estimated in the different scenarios.

Table 7-2 Effects included in the analysis of total cost/benefits for ship dismantling in the scenarios

<table>
<thead>
<tr>
<th>Reference scenario</th>
<th>Pre-cleaning scenario</th>
<th>Full green dismantling scenarios</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transport costs for last voyage*</td>
<td>X:</td>
<td>X</td>
</tr>
<tr>
<td>Risk of accident on the last voyage</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Pre-cleaning costs</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Towing costs from pre-cleaning to dismantling site</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Risk of accident by towing</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Ship end-of-life value **</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td><strong>Net revenue from recycling</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* 'Last voyage' meaning after a cargo has been delivered in last port of call to the scrapping/pre-cleaning facility.

** The ship end-of-life value is for the ship in the current state, which for example means the pre-cleaned ship in the pre-cleaning scenario. The value is expected to vary considerably between the different scenarios first of all as a consequence of the different recycling standards and techniques applied.

The transport costs are the costs of sailing an empty ship on its last voyage from the point of departure to the final destination, i.e. the dismantling or pre-cleaning site.

The cost from risk of accident is the expected costs of losing a ship (see section 6). It is calculated as the risk of accident multiplied by the revenue from ship sale.

The pre-cleaning costs have been estimated using different approaches for deriving the costs. This estimate is based on interviews with a number of key
stakeholders about the costs and actual prices, and on the present work’s calculations of the pre-cleaning costs based on observed transactions.

Interviews with key industry players have been carried out to estimate the costs of transportation (towing) of the vessel to developing countries.

The costs of dismantling have also been obtained using different approaches to derive the costs. First of all, a top-down approach in which the price of dismantling has been directly determined from contracted transactions (or directly by information from the industry) has been applied. This means that the price has been based on data from the Clarkson database.

The prices available from Clarkson mostly reflect the price for scrapping of vessels in Asia where the conventional beach breaking method is applied (the reference scenario). Unfortunately, it is not possible to extract information about prices for vessels that have been scrapped at a "green" recycling facility from Clarkson's as the number of facilities offering green recycling is limited in Europe and globally. Until recently, the market for such services has been limited to a few governmental programmes and concerned companies, and a competitive market for these services has yet to emerge. Green recycling of ships is, generally, considered more expensive than traditional breaking due to the costs of measures taken for the benefit of the environment and worker’s health and safety.

The figure below shows scrap prices per LDT for the last three years for selected Asian countries.

![Scrap prices by country, year 2004-2006](image)

Note: Calculations based on Clarkson data for 295 ships, the majority in Bangladesh.

*Figure 7-1   Scrap prices by country, year 2004-2006*

The figure shows that there are some variations in prices between countries.
The variations are due to several factors including differences in labour costs, local steel prices, local taxes and local differences in prices for second hand materials. However, the type and the size of vessels scrapped are also important: Due to a favourable ratio of steel to non-reusable items tankers generally fetch higher prices, whereas other vessels such as passenger ships, ferries, and car transporters may command 100 USD less per tonnes.

Table 7-3 Average scrap prices by type, year 2002-2006

<table>
<thead>
<tr>
<th>Type</th>
<th>Average USD/LDT</th>
<th>Number scrapped</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oil tanker</td>
<td>399</td>
<td>177</td>
</tr>
<tr>
<td>Gas</td>
<td>386</td>
<td>15</td>
</tr>
<tr>
<td>Other cargo vessel</td>
<td>354</td>
<td>38</td>
</tr>
<tr>
<td>Container</td>
<td>333</td>
<td>2</td>
</tr>
<tr>
<td>Bulk carrier</td>
<td>324</td>
<td>43</td>
</tr>
<tr>
<td>Other tanker</td>
<td>300</td>
<td>3</td>
</tr>
<tr>
<td>Passenger/ro-ro/vehicle</td>
<td>266</td>
<td>10</td>
</tr>
</tbody>
</table>

Source: Clarkson

In ship breaking countries in Asia, costs associated with health, safety and environmental standards are relatively low, as these are not an issue at most recycling facilities. Hence, costs associated with health, safety and environmental issues play only a minor role compared to labour costs. However, they probably still explain a small part of the cost difference between countries in Asia. Further, the costs are generally rising as standards are tightened (for example India recently introduced a rule calling for gas-free working environment for hot work which has reduced their market share).

As an alternative to obtaining the price of recycling from Clarkson, the price could be derived from a bottom up financial analysis of a ship breaking facility. However, a full analysis is out of scope due to the complex nature of the industry and is a problematic approach which has to rely on (too) many assumptions.

Interviews with key industry players have been carried out to estimate the costs of dismantling and pre-cleaning of ships in EU. This has been supplemented by data from the study "Oil Tanker Phase Out and the Ship Scrapping Industry" (COWI/DG TREN 2004) on the cost of green recycling. Finally, the latest available public information about costs has been investigated through an internet search.

7.3 Case analysis

The financial consequences have been analysed using a case analysis approach. As mentioned above a tanker is a good representative for the different ship types and therefore the calculation of costs and benefits has been carried out for a medium-sized tanker.
7.3.1 General assumptions

The analysis has been built up around an oil tanker which was actually scrapped in Asia in 2006. Exact characteristics of the tanker are provided in the table below.

**Table 7-4 Characteristics of the tanker selected for case analysis**

<table>
<thead>
<tr>
<th>Name</th>
<th>Venture III</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td>Oil tanker</td>
</tr>
<tr>
<td>DWT</td>
<td>82,006</td>
</tr>
<tr>
<td>LDT</td>
<td>15,432</td>
</tr>
<tr>
<td>Date of demolition</td>
<td>May 2006</td>
</tr>
<tr>
<td>Country of demolition</td>
<td>Bangladesh</td>
</tr>
<tr>
<td>Price (USD per ldt)</td>
<td>380</td>
</tr>
</tbody>
</table>

The table shows that the selected ship is an oil tanker that was scrapped in Bangladesh in May 2006 for a price of 380 USD per LDT.

The following general assumptions have further been applied:

- Breaking and pre-cleaning destination EU: United Kingdom, London;
- Breaking destination Asia: Bangladesh, Chittagong;
- Breaking destination OECD: Turkey, Izmir;
- Towing route United Kingdom to Bangladesh via Suez Canal or round Cap of Good Hope (cheapest option).

7.3.2 Costs of dismantling and pre-cleaning of ships

Below, it is briefly described how the cost elements in the case analyses have been estimated.

It should be noted that it is a quite difficult task to estimate some of the cost elements. The estimates and calculations are associated with substantial uncertainty and as a consequence the quantitative analysis is more indicative than precise. It provides the right order of magnitude rather than the exact level.

Transport costs for last voyage and risk of accident on the last voyage

Conventionally, a commercial vessel will carry cargo to Asia to a port close to the breaking beach. It has therefore been pragmatically assumed that the destination for a vessel's last voyage with cargo is so close to the final recycling destination (or pre-cleaning destination) that the transport costs for the final leg and the costs from risk of accident on the last voyage are ignored (or estimated being close to 0).
Pre-cleaning costs

It is difficult to generalise the costs of pre-cleaning as it depends on a number of factors specific for each vessel, such as ship size, type, cargo type, maintenance level and repairs and refitting. Therefore estimates are highly uncertain. In general the costs of performing pre-cleaning comprise:

- manpower costs for safe removing of the hazardous waste,
- hazardous waste disposal costs,
- construction costs for new equipment, machinery and infrastructure necessary for safe separation and containment of hazardous materials from the ship.

In the study "Oil Tanker Phase Out and the Ship Scrapping Industry" that COWI performed for DG TREN, the cost of performing pre-cleaning of a ship and disposal of hazardous waste was estimated by industry sources to be around 25 - 50 USD/LDT in Asia, but higher in Europe due to higher labour costs.

In this study we have tried to investigate prices of actual pre-cleaning of ships in EU.

- The Sandrien is a chemical tanker of 8,380 LDT built in 1974. The ship was owned by an Italian shipping company when it arrived in Amsterdam in August 2000. Shortly after its arrival in Amsterdam harbour, the ship was detained by the port authorities due to its technical state. The ship inspectors decided that the vessel was only allowed to leave Amsterdam after undergoing fundamental repairs. The inspectors further informed the environmental inspectors on the suspicion that the ship contained hazardous materials and could be bound for scrapping. In February 2001, the Dutch Environmental Inspectorate arrested the Sandrien as the ship contained hazardous materials, for instance asbestos and heavy metals, and there was a contract on scrapping the ship in Asia. Such export to Asia would violate the European Waste Shipment Regulation. After several court procedures the Council of State in the Netherlands in June 2002 ruled that an end-of-life vessel not properly cleaned of hazardous materials should be classified as hazardous waste. Consequently Sandrien was detained in the Netherlands for cleaning and scrapping.

The Dutch Ministry of Environment (VROM) is a key stakeholder in the affair. According to the Ministry (Mr. Cees Luttikhuizen) the cost of removing the asbestos from the ship accounted to approx. 700,000-800,000 EUR and a fair estimate of the costs of removing other chemicals and waste is approx. 100,000 EUR. Hence the total cost of "pre-"cleaning of Sandrien amounted to app. 800,000-900,000 EUR. This is equal to approx. 100 EUR per LDT.

- The report "National Guidance: Best Management Practices for Preparing Vessels Intended to Create Artificial Reefs" by U.S. Environmental Protec-
tion Agency (2006) provide guidance recommending environmental best management practices to be used in the preparation of vessels for use as artificial reefs. Even though the cleaning is not done according to the same standards applied to pre-cleaning for scrapping, the process is comparable. The report provides a basis for estimating the costs associated with the preparation of vessels for use as artificial reefs as it include estimates for two vessels:

<table>
<thead>
<tr>
<th>Name</th>
<th>USS Spiegel Grove</th>
<th>USS Oriskany</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type of Vessel</td>
<td>Landing Ship Dock</td>
<td>Class Aircraft Carrier</td>
</tr>
<tr>
<td>Overall length</td>
<td>510 feet</td>
<td>911 feet</td>
</tr>
<tr>
<td>Weight</td>
<td>7,000 LDT</td>
<td>32,000 LDT</td>
</tr>
<tr>
<td>Total clean-up</td>
<td>USD 625,000</td>
<td>USD 8,000,000 40</td>
</tr>
<tr>
<td>Ship clean-up time</td>
<td>7 months</td>
<td>12 months</td>
</tr>
</tbody>
</table>

• For the small vessel USS Spiegel Grove the cost per LDT accounted to approx. 70 EUR. For the larger carrier Oriskany the cost per LDT accounted to approx. 190 EUR.

• The pre-cleaning cost of HMS Scylla: 1.2 million £ for 2,500 displacement tonnes. At the present rate of 1.94 USD/GBP this is approx. 2.3 million USD or 930 USD/LDT. It should be mentioned that this figure also includes demilitarisation costs.

• Pacific Nuclear Transport Limited (PNTL), a subsidiary of British Nuclear Fuels (BNFL), exported two of its decommissioned nuclear fuel carriers to the Netherlands for recycling. The owners could have netted approximately one million pounds per vessel if they had been recycled in India due to the value of scrap steel at the time. However, recycling of the vessels in the Netherlands resulted in a cost to PNTL of several hundred thousand pounds per 4000 tonne vessel (UK Defra 2006).

Though highly uncertain, the price of pre-cleaning of the Sandrien is assessed to be the best proxy for the price for Venture III. Taking account also of the information about cleaning of the American vessels it is estimated that the pre-cleaning costs will be in the range of 75-150 EUR per LDT (100-200 USD per LDT).

Towage costs for towage from pre-cleaning to dismantling site

The towage costs have been estimated based on information obtained from interviews with key stakeholders involved in the towing business.

40 The total clean-up cost is given as USD 15,630,000, but includes significant demilitarisation. The cost of pre-cleaning for hazardous materials on USS Oriskany is quoted as USD 8,000,000 in Assemblée Nationale (2006).
• Towing of the ship *Otapan* from Amsterdam to Turkey. The Dutch Ministry of Environment (VROM) was involved in the planning, which was undertaken by Landfall. The total price was 205,000 EUR, which reflected that Landfall would return with another ship. However, Otapan had to be returned to Amsterdam as the deal with the Turkish scrapping company was cancelled. The cost of the return-tow was 350,000 EUR and the operation took 30 days. On this basis a price of towing a pre-cleaned ship can be estimated to app. 8,000-10,000 EUR per day. This estimate was confirmed by Joep Caesmaat from Landfall.

The price of towing around Cape of Good Hope is calculated using an estimated cost of 10,000 EUR per day and estimated 85 days (travel speed of 5 knots and a distance of 10,800 nautical miles); so the total costs of towing of *Venture III* from London to Bangladesh would have been 850,000 EUR or 55 EUR per LDT (65 USD per LDT).

The costs of passing through the Suez Canal can be obtained from Leth Agencies (http://www.letshsuez.com/tariff_07.htm). From their homepage the total toll for Suez Canal transit can be calculated for a specific ship (http://www.lethagencies.com/calculator.asp?Port=SUEZTREG). The toll for *Venture III* has been calculated to approx. 295,000 USD.

Again using an estimated cost of 10,000 EUR per day and a duration of 55 days, the costs of towing of *Venture III* from London to Bangladesh is estimated to 550,000 EUR. The total price including Suez Canal toll is thus 845,000 or 55 EUR per LDT (65 USD per LDT).

This confirms the common understanding in the industry that the price is set so that it is marginally cheaper passing through the Suez Canal than going around Cape of Good Hope.

**Risk of accident by towing**
The risk of accident by towing was addressed in section 6. Here it was estimated that the risk of accident by towing is only slightly higher than the risk for normal overseas navigation.

The risk of losing a ship that is being towed from London to Bangladesh was calculated to approx. 0.02%. For *Venture III* this is equal to expected costs of 120,000 EUR in total or approx. 10 EUR per LDT (15 USD per LDT).

**Revenue/costs of a ship sold for recycling (end-of-life value)**
The economics of the ship recycling industry and the forces behind demand and supply on the ship recycling market are interrelated with three other markets that ship owners operate on: the new building market, the second-hand market and the freight market. To some extent the ship recycling market serves as a buffer balancing demand and supply in the freight market with increase scrapping when the global demand for sea transport moderates.
Freight rates

Freight rates are by far the most important driver for the ship owner's decision on when to scrap a vessel (COWI/DG TREN, 2004). With booming rates, nobody recycles ships unless forced to do so for regulatory or technical reasons. Hence, the high freight rates from 2003-2006 can explain the limited recycling volumes in the same period (see Figure 3-11). This was also demonstrated in a recent article in the BIMCO Bulletin (2006).

If the price obtainable in the demolition market is a significant driver for the decision of the ship owners on when to scrap, there should be a close and positive correlation between prices and volumes of decommissioning. However, prices and volumes are actually negatively correlated, i.e. when volumes go down, prices increase (see figure below). This indicates that other factors (e.g. the developments in the freight market) are more important for the ship owner's decision.

![Average scrap price and volumes of scrap by year of scrapping (all types)](image)

Source: Own calculations based on Clarkson data

Figure 7-2  Average scrap price and volumes of scrap by year of scrapping (all types)

The main driver for the ship owner's decision where to scrap is the price offered by the ship breakers.

With the current practice used, ship breaking is a very labour-intensive industry. Labour costs therefore play a predominant role in determining where ships are scrapped and have been scrapped historically. This is reflected in Figure B-1 in Appendix B, which shows that the Indian Sub-Continent (India, Bangladesh, Pakistan) and China account for almost 90% of the ship breaking. This finding is generally in line with the findings of the COWI/TREN study.

There have been considerable variations in the market shares of the major ship breaking nations over the years. The figure below shows that Bangladesh today
accounts for the largest share, while only 5 years back in time India was the world's largest ship breaking nation.

![Market share of main ship breaking nations, 1994-2006](image)

**Figure 7-3 Market share of main ship breaking nations, 1994-2006**

**Price of recycled steel**

Steel from ships comprises less than 2% of the total consumption of recycled steel world wide (BIMCO, 2002) and therefore the level of ship scrapping activity plays a negligible role in determining the price of recycled ships. In fact it is the other way round. Once a ship owner has decided to scrap a vessel, the price offered by the ship recycler is heavily influenced by the price of second-hand materials, in particular the price for reusable steel. When the demand for steel and other reusable items grows, steel prices increase and the ship scrappers' earning potential also increases. As a consequence the ship scrapper's willingness to pay for a vessel for decommissioning grows (and vice versa for a weakening in the demand for steel and other reusable items).

**Labour costs**

Ship breaking is a labour-intensive industry and therefore labour costs play a predominant role in determining where a ship is scrapped. Labour rates are 20-100 times higher in Europe compared to India/Bangladesh (http://laborsta.ilo.org/). This is by far the main reason why breaking historically has moved to Asian countries and why European countries are not operating in the market today.

**Variations**

This nature of the recycling market means that the price of ships for recycling varies considerably over time. Below scrapping prices have been estimated as an indication of the global steel market situation at the time when the oil tanker was sold.

However, it should also be noted that the ship scrappers are operating in a global market, which is confirmed by the fact that the price trend in the scrapping countries of Asia is remarkably similar with only minor differences between countries. This is in particular confirmed by the figure below showing
the average scrap prices over time for selected countries (reproduced from COWI/DG TREN, 2004).

![Scrap price - Selected countries (to allow comparison only oil tankers are included)](image)

Source: Own calculations based on Clarkson

**Figure 7-4 Scrap price - Selected countries (to allow comparison only oil tankers are included)**

As earlier noted the price of recycled steel is the most important factor determining the price offered for a ship for recycling. This potentially means that the highest price could be offered by scrappers located in areas where the price of steel is highest. However, this holds true only to a limited extent as steel is an internationally traded commodity that can be relatively easily transported from a scrapping location to a destination where it is needed.

In fact, it is a common misconception that scrapping takes place in Asian countries (India, Pakistan, Bangladesh and China) only due to the fact that these countries have either a booming economy with a high construction activity or very few domestic metal resources and consequently a high demand for (recycled) steel.

The cost of transporting steel from Europe to Asia is in the range of 10-15 USD per tonne, while the cost of a transport from India to China is in the range of 3-5 USD per tonne\(^\text{41}\). These figures should be compared to prices of steel in the range of 400-650 USD per tonne depending on type (2006-prices, source: [http://www.meps.co.uk/world-price.htm](http://www.meps.co.uk/world-price.htm)).

This proves that local variations in steel prices only play a small role in determining where a ship is recycled. Indeed other factors are much more important,

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\(^{41}\) Based on an average rate per day for a Panamax Bulk Carrier DWT 75,000 of 30,000 USD (source: Clarkson) and assuming a travel time of 20-40 days Europe-Asia and 7-15 days India-China.
primarily local labour costs - as recycling (using the conventional beaching method) is a labour-intensive industry - and secondly environmental, health and safety regulations.

**Summing up main drivers**

The main drivers in the scrapping industry can simplistically be described as follows: Freight rates determine *when* to scrap. Labour costs determine *where* to scrap. Steel prices determine the size of the ship owner's profit.

**Conventional beaching**

The price of a ship that has been sold for demolition using the conventional beaching method can (most often) be directly obtained from Clarkson for most vessels. Hence, it is reported that *Venture III* was sold for scrap for a price of 380 USD per LDT, which equals approx. 5.9 mill. USD. This reflects the price for scrapping in Bangladesh May 2006.

This price level is confirmed by prices reported by GMS in May 2006 for scrapping in Bangladesh, India and Pakistan[^42], but in some cases prices up to 500 USD/LDT have been paid.

**Green recycling, EU**

Only a few recycling facilities exist today in the EU. They are able to perform "green recycling" of ships, but the capacity is limited and they do not dismantle the large-size ships, such as VLCC or ULCC. Hence, only few ships have been scrapped at a "green" recycling facility in the EU. As a consequence, prices paid for ships scrapped at a green recycling facility can not yet be observed in the market.

European ship recycling companies have been contacted and inquired about the costs of green recycling. However, with few exceptions the industry is reluctant to provide information about the price that they are willing to pay for a specific ship or about costs involved in the recycling process.

Van Heyghen Recycling in Belgium is one of the largest active recycling companies in Europe. Van Heyghen Recycling claimed that the company would be willing to pay approx. 100 EUR per LDT excluding, however, the costs of cleaning the ship of hazardous waste. In particular the manager emphasized that the cost of removing asbestos often proves important.

The 100 EUR per LDT (130 USD per LDT) expresses the net value of the recyclable steel without labour and capital costs of dismantling the ship. Even when the process of recycling is undertaken in EU with a higher degree of automation and use of machinery it is still a labour-intensive process. This is the main reason why the value of an end-of-life ship is much lower for a European ship recycling company than for an Asian company.

HKS Metal’s facility in Gravendeel (slipway and pier breaking) mostly scraps inland-water vessels, and can dismantle vessels up to 4,000 LDT. They report that they buy vessels at 140-150 EUR/LDT (180-200 USD per LDT). This is approx. 70-80 EUR less than the steel smelters buying price to cover the costs (and profits) of dismantling the vessel. In the price the cleaning costs for oil,

fluids and asbestos are not included. These costs are usually covered by the seller of the vessel. Hence, HKS Metal’s facility seems to be able to pay a higher net price than Van Heyghen Recycling.

The cleaning costs in relation to a full green recycling are likely to be the same or less than those occurring when a ship is pre-cleaned because the cleaning process is easier as it can be done in an integrated process with the dismantling of the ship. Using the pre-cleaning costs calculated above, the cleaning costs in relation to full green dismantling are estimated at 50-150 USD per LDT. These costs will heavily depend on the quantities of asbestos, lead and other hazardous waste.

Hence, using these estimates the net price that a European recycling facility should be prepared to pay for a vessel ranges between 20 and 130 USD per LDT.

GMS\textsuperscript{43} is one of the largest cash buyers of vessels for recycling in the world. According to GMS, facilities in India, Bangladesh and Pakistan offered prices for tankers around 360-380 USD per LDT in May 2006, whereas Turkey was paying in the region of 225 USD per LDT for tankers at the same time and this was comparable to the prices in China.

The price variation reflects the difference in method applied and not least the difference in labour rates.

7.3.3 Case analysis results

The table below summarises the estimated effects in the four scenarios. The effects were discussed and estimated in the section above and apply to the representative case of a medium-sized tanker. Again it should be noted that estimates and calculations are associated with substantial uncertainty. As a consequence, the quantitative analysis provides the right order of magnitude as the difference in the net profit for ship owners in the four scenarios.

<table>
<thead>
<tr>
<th>USD per LDT</th>
<th>Reference scenario</th>
<th>Pre-cleaning scenario</th>
<th>Full green dismantling, EU</th>
<th>Full green dismantling, Turkey</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-cleaning costs</td>
<td>0</td>
<td>-200 - -100</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Towing costs from pre-cleaning to dismantling site</td>
<td>0</td>
<td>-65</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Risk of accident by towing</td>
<td>0</td>
<td>-15</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Ship end-of-life value</td>
<td>380</td>
<td>380</td>
<td>-20 - 130</td>
<td>225</td>
</tr>
<tr>
<td>Net revenue from recycling</td>
<td>380</td>
<td>100 - 200</td>
<td>-20 - 130</td>
<td>225</td>
</tr>
<tr>
<td>Difference to reference scenario</td>
<td>-</td>
<td>180 - 280</td>
<td>250 - 400</td>
<td>155</td>
</tr>
</tbody>
</table>

\textsuperscript{43} See http://www.gmsinc.net/gms/profile.php
The table shows that the reference scenario results in expected revenue of 380 USD per LDT which is equal to the price paid by the cash buyer on delivery for beaching and breaking in Asia.

The Turkish scrapping industry is also in a position to pay for the vessels and currently acquire vessels for demolition in the free market. Consequently, in the scenarios with full green dismantling in Turkey the ship owner's expected revenue equals the price paid of 225 USD per LDT. The net difference to the reference scenario is approx. 150 USD per LDT.

The ship end-of-life value for a European demolition company has been prudently estimated to 20 to 130 USD per LDT. The cost difference to Turkey is primarily due to higher wages in EU countries compared to Turkey. The industry in Turkey thus enjoys an unrivalled advantage over any existing alternative European site. The minimum wage in Turkey is a fraction of the wage in many EU countries, but comparable to the minimum wages in some of the recent Eastern European members to the EU. The net difference to the reference scenario is approx. 250-400 USD per LDT.

The calculated relative cost difference between reference scenario and the full green dismantling scenario is associated with uncertainty as no ships are actually scrapped in Europe to allow direct comparison of prices paid. However, the relative cost difference has been checked using an alternative rough approach. In a recent report by the French Secrétariat Général de la Mer the productivity in terms of steel cut has been estimated for Asian and European scappers. It is estimated that the productivity in Europe is approximately 10 times higher compared to the Asian scrapping facilities, i.e. steel cut per worker per year is 300 to 1200 tonnes, while in Asia it is 30 to 80 tonnes per worker per year (Annexe XVI, p.143). Taking account of the much higher labour costs in Europe, i.e. approx. 50 times higher, the production costs not taking account of capital costs are roughly 5 times higher in Europe compared to Asia. A rough estimate of production costs could be in the order of 50 USD per LDT (steel price of 500 per tonne, price paid per LDT of 400 USD and profit of 50 USD). Using the calculated productivity factor of 5, the production costs in Europe can be estimated at 250 USD per LDT. Adding capital costs and taking account of slightly lower prices for reusable steel in Europe, a costs difference of 250 to 400 USD per LDT seems plausible.

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44 Prices vary depending on vessel type and conditions of individual vessel.
45 The minimum wage in Turkey is approx. 300 EUR per month, which as an example is app. half of the minimum wage in Spain or Greece (http://www.fedee.com/minwage.html). Minimum wage the US is approx. 480 EUR per month.
47 Estimated to 30 to 100 EUR per LDT in the French report, which equals 40-130 USD per LDT (Annexe XVI, p. 140).
The price disadvantage for both the Turkey and the EU full green dismantling scenario is counterbalanced by other factors that are in favour of these countries in terms of labour, safety and indeed environmental conditions.

Finally, the pre-cleaning scenario has been estimated to result in expected revenue of 100-200 USD per LDT for the ship owner. The estimate is associated with uncertainty as especially the costs of pre-cleaning have been difficult to estimate and heavily depend of the specific characteristics of the vessel, i.e. the configuration of the materials onboard a vessel. The net difference to the reference scenario is app. 180-280 USD per LDT.

The calculated cost difference of the various scenarios relative to the reference scenario indicates the 'incentive gap' for the industry to choose these options over the traditional beaching in Asia. The calculated cost difference thus essentially expresses the size of a subsidy needed in order for a ship owner to find it attractive to use a European facility over an Asian facility.

The cost difference relative to the reference scenario for all alternative scenarios is substantial, which points to the fact that the options are dependent on substantial government subsidies and public funds or other regulatory measures.

7.4 Generalisation and sum-up

The section above discussed and estimated the effects for the case of a medium-sized tanker. Costs will differ for other types and different sizes of ships.

Generally the cost difference must be expected to increase (in relative terms) with the size of ships as the man-hours needed to dismantle the ship increase with the size. Since labour cost is the most important cost driver of dismantling vessels, this means that the advantage of low-cost countries over high-cost countries increases in relation to the size of the ship.

For small ships (<2,500 DWT) the advantages of the low-cost countries is relatively smaller, which also explains why ships operating solely in Europe are often dismantled in Europe (especially in Turkey). The costs of transporting the ship to Asia simply outweigh the relative price difference for small end-of-life ships in Asia and Europe.

The ship type is also important for the price difference. Two factors play an important role: The complexity of the ship structure and the configuration of materials of a vessel.

The more complex a structure of a vessel, the more man-hours are needed to dismantle the ship. This means that tankers, bulk carriers and container ships are easier to dismantle than passenger/ro-ro ferries and non-cargo vessels. Consequently again the costs difference must be expected to be relatively higher for ships with a complex structure.
The configuration of materials is also important for the man-hours needed to dismantle the ships - especially for environmentally safe dismantling in Europe. The more hazardous materials on a vessel, the more man-hours are needed. Furthermore, the cost of disposing the waste increases with the amount\textsuperscript{48}. Both factors eventually lead to higher costs for cleaning the vessel.

**Sum-up**

From the results of the case analysis in section 7.3 it can be noted that from a strictly economic perspective the most attractive alternative to beaching in Asia is dismantling at a Turkish site. Turkey is a member of OECD, is a Party to the Basel Convention and is a member of the International Maritime Organization (IMO). While the solution might be economically sound/acceptable it is still to be assessed whether it is environmentally, socially and consequently politically acceptable.

Economically, the second-best alternative seems to be the option with pre-cleaning in Europe and dismantling in Asia. As discussed in previous sections of this report, there are however a number of problems and open questions associated with this option. These include:

- Environmental risk involved with towage of the vessel,
- Practical problems with the cleaning process (continued health and safety hazards for scrapping personnel),
- Practical problems of beaching the vessel under tow,
- The dangerous and hazardous working conditions embedded in the beaching method used in dismantling in Asia would remain unchanged.

On the other hand pre-cleaning has a clear advantage as it will not require any major development of facilities since it could be undertaken at existing repair yards in Europe.

The high cost of European labour coupled with the cost of complying with all workers’ health and safety and associated environmental regulations in Europe is the reason why the scenario with full green dismantling in EU is the least attractive alternative.

Today the capacity for dismantling all European owned/flagged vessels does not exist. But as described in chapter 4, there are no technical constraints for establishing the capacity. If the framework conditions are changed so that there is a real incentive to scrap in Europe, the industry will establish sufficient capacity to meet the demand. However, it should be underlined that the EU scenario is far from being self-supporting and a scheme which ensures that there is a real incentive will have to rely on generous subsidies or other radical measures. This is further discussed in the next chapter.

\textsuperscript{48} Whether or not there are toxic or other environmentally problematic substances on board does not affect the price in Asia.
8 Different options for developing strategies for ship dismantling in the EU

8.1 Barriers, options and incentives

As pointed out in the COWI/DG TREN study (2004), the challenge for the EU and the Member States for developing viable strategies for ship dismantling in the EU is associated with the lack of economic incentive to perform recycling in Europe and to the global nature of the shipping business, operating without barriers to the trade of near-end-of-life ships.

To avoid the scrapping of ships under unacceptable conditions a number of actions can be envisaged. Basically, there are three types of instruments available for handling this situation:

- Regulation. Although IMO is underway with a convention on ship recycling, the process is long and enforcement problems must be anticipated. EU interim measures may be necessary.

- Economic instruments. A number of instruments allowing ship owners to choose acceptable scrapping have been brought forward.

- Information. Raising awareness among ship owners, authorities in breaker countries, workers and other stakeholders.

Recommendations for these instruments should be directed towards establishing incentives for the development and promotion of green recycling capacity and to the supply of vessels to recycling in a safe manner. Regardless of the instruments chosen the core questions are:

- How do we get more green recycling capacity?

- How do we get more ship owners to use it?

- How can we provide more incentive? and

- Who is going to pay for all that?
To take the last question first, the established waste policy of the EU includes “the polluter pays principle”. Also, concepts aimed at enhancing the responsible approach of the producers of services and product, e.g. product stewardship and sustainable business development, are firmly rooted in EU environmental policy. Therefore, incentives to promote these attitudes amongst the European industrial leaders are already available although not directed specifically towards the shipping industry.

In addressing the unique and strongly global nature of shipping it is possible that the industry requires its own instruments or modifications of existing instruments special for the shipping and ship recycling industry. These issues will be addressed in this Chapter.

A number of options for promoting safe and environmentally sound ship recycling have been mentioned in previous studies, among them:

- Support to the green facilities to increase their competitiveness, e.g. R&D, technical assistance, procurement of equipment.
- Subsidies, tax benefits etc. to ship owners using green recycling.
- Technical assistance to the development and implementation of national roadmaps to improved conditions in breaker yards.
- Assisting to the shipping industry, e.g. with development of certification/auditing activities for green recycling facilities and lists of approved facilities.

Considering the development over the last 30 years in European and global ship recycling, it is obvious that today’s ship recycling takes place where the costs are the lowest. In the shipping industry where the assets, in this case the hulls, are movable with few regulatory strings attached, there is no economic incentive to choose a European yard regardless of its compliance with any safety, health and environmental regulation applicable.

The one force that closed the local European recycling industry and fostered the Asian was profitability. More than anything, the profitability is based on the cheap labour costs in the beaching nations of Asia, but also the ignorance of basic safety, health and environmental considerations and the almost complete absence of investment needs for infrastructure, and adds to the economic lure of beaching.

There is no advanced technology associated with ship recycling and safe recycling of ships can take place anywhere in Europe or in upgraded “green” facilities elsewhere in the world. However, the willingness of the recyclers to invest in facilities delivering “green” recycling is based on their expectations for the market. Today, one of the primary barriers to the economic feasibility of a “green” yard is how to ensure a steady supply of vessels to the facility, if the not so eco-friendly yard next door or in a neighbouring country offers to pay 100 USD more per LDT?
8.2 Ensuring a supply of vessels

8.2.1 Government vessels
One of the ways to provide raw material to the “green” yards is by channelling government-owned vessels to the yards. As seen earlier, supply from governments in terms of naval vessels is 40-45,000 LDT/year. This corresponds to one or two yards the size of the existing European recyclers of inland and smaller vessels. It must be recalled that not all of these vessels go to Asia or Turkey; with the possible exception of the largest (frigates, destroyers and air craft carriers) many of them are recycled at the existing yards in Europe.

The large vessels are the challenge. Dismantling a large vessel obviously requires more space, may require bigger cranes and other investments. If the extra supply of government vessels falling under the WSR is to be leverage for a recycling capacity in the EU that may also address the commercial market, public international tendering of these government vessels should be enforced. Otherwise there will be a risk that the most efficient recycling yard(s) cannot access their potential supply base.

It is assumed that naval vessels and other government vessels will be recycled in the EU or OECD, thus not violating the WSR, and no need for additional regulation or incentives are needed with the exception of public tendering.

8.2.2 Merchant fleet
The tonnage of merchant vessels under European flags are a much larger volume and could form a much more stable supply base for a European recycling industry. A considerable tonnage is in theory affected by the WSR (up to some 2.1 million LDT/year), but in reality few vessels are directly affected by the Regulation since ships flying the flags of the EU Member States may very well become waste outside of Europe. Also, there are no legal obstacles to the transfer of an old vessel to an other flag or it may be sold and resold and soon end as a scrap vessel. In some flag states the implementation and enforcement of the law regarding the scrapping issues may be expected to be somewhat lax.

However, at some point the competent European authorities could choose to consider a certain reflagging rate and sale volume of former European-flagged vessels as a de facto evasion of the WSR leading to export to the existing sub-standard facilities. It has been suggested from NGOs and some member states that not the flag state, but the country of the company owning or controlling the vessel should determine the applicability of the WSR. It is beyond the scope of the present study to establish the potential consequences for the European shipping industry including the future company registration pattern when it comes to ownership of near end-of-life vessels.

For the purpose of the study the recycling of 1.3 - 2.1 million LDT/year presently operating under EU member state flags are sufficient to demonstrate the range of costs associated with the establishment of a “green” recycling capacity. This number may be somewhat inflated as the trading pattern for EU mem-
ber state flags often involves selling older vessels for continued trading and investing in a younger fleet. At the projected time of scrapping a significant part of the vessels may no longer be flying the colours of a European member state.

A limited number of European ship owners already developed company policies on ship recycling that oblige them to safe recycling of their own vessels. These include P&O Nedlloyd (now Maersk Line), Shell and BP Shipping. It must be expected that these company are prepared to pay the premium needed to finance the EHS investments, i.e. the companies are willing to cover the difference between beaching (at some 350-400 USD/LDT) and the price level at acceptable yards. Although not explicitly stated, the companies generally maintain that the upgraded procedures in Turkey and China are acceptable as safe and environmentally sound ship recycling, and price offered from these facilities amount to some 220 USD/LDT. The responsible ship-owners therefore experience a loss of 130 USD/LDT compared to their less conscious competitors.

The possibilities for providing incentives for the supply of vessels from the merchant fleet include:

- Rigorous legislation on sale conditions (e.g. “vessel must be scrapped according to WSR and EU standards regardless of future flag”)
  
  *This will obviously cost the ship-owners when selling. Enforcement should be via the arbitration courts, but it is not hard to foresee that recovery of profits in violation of contract conditions 5-10 years after a sale will be very difficult.*

- Take-back approach
  
  *Developing a "take-back" approach where the building yards are charged with the responsibility to have the vessels demolished has virtues in terms of forcing product sustainability thinking onto the manufacturers, but the 25 – 30 years time lag is problematic.*

  *A global fund has been proposed and is a possibility although only a truly global levy system will ensure coverage. A problem is that it may have to be the owner of today that ends up paying for the years of profitable usage by other owners.*

- Full or partial coverage of the loss associated with “green” recycling compared to beaching.
  
  *The approx. 130 USD/LDT less in Turkey or China could be subsidised upon presentation of a Completion form or deductible on the tax.*
8.3 Strategies to strengthen capacity in EU based facilities

It is a challenge to ensure the use of the presently available capacity of European green recycling facilities and expand the capacity in Europe, when the supply base is limited to government and fishing vessels.

The shipping industry and the merchant fleet are optimised to deliver efficient transport services from port to port, and the current law is directed to facilitate this for a truly globalised industry. The end-of-life situation for vessels has not until the last decade come under scrutiny, and since the activity is land-based, this has been considered a matter of national authorities and no responsibility is placed on the ship owner in that respect.

The European Waste Shipment Regulation applies to the scrapping of vessels and floating structures, but it has been very difficult to prove a ship owner's intent to dispose of a vessel while under EU jurisdiction. Only ship owners with a very clear company policy will scrap ocean-going vessels in Europe today, since the net loss will be several million Euros compared to a beaching in Asia.

The development of a convention on ship recycling in IMO will assist in transforming the shipping and recycling industries. However, if recycling countries are slow in ratifying or the flag states lack in enforcing or some countries refrain from becoming a Party in order to develop their own low-standard scrapping industry, the impact of the convention may be limited. Anyhow, even if the convention holds the promise of "equivalent level of control", the ratification process means that it will not enter into force until at the earliest in 2013. Interim measures will be needed both to ensure the phase-out of unacceptable practises and to assist in providing green recycling capacity to the countries that adopt the new rules already upon signing the convention, incl. the EU Member States.

Several companies in the EU are developing capacity for green recycling, but none sees a profitable business in direct competition with Asian ship breaking yards. There are only limited options for enforcing scrapping in the EU if ships are reflagged before scrapping and it may be argued that green recycling of a vessel can be carried out equally good in Asia and in the EU, if properly developed. Even if Asia is accepted as the present and future prime ship scrapping destination, problems remain in developing technical solutions to the extent of the necessary pre-cleaning of ships, the discontinued use of the beaching method and other requirements of a coming convention.

8.3.1 Development support to green facilities in the EU

Various instruments besides "command and control" can be brought into use to either support the European or the developing countries in green recycling. These may in Europe include support from EU R&D programmes, regional and SME (Small and Medium-sized Enterprises) development programmes or direct subsidies. There are several green recycling initiatives in EU Member States that can provide good practice working methods that could be promoted.
at international level and/or exported to developing countries. Those initiatives would prove that environmentally sound recycling practices are compatible with an economically viable recycling activity.

The Dutch facility Ecodock has been under planning for some years now. It was expected to be on the market in 2006, but has yet to move into the physical world. The difficulties experienced show that even with support of several EU programmes and private investors, the market conditions are not favourable for green recycling.

Increased support to development of green facilities in EU and to the improvement of Asian breaker yards probably could deliver "fast-track" solutions by upgrading existing facilities with demonstration projects, but they should be coupled to improve the market conditions.

### 8.3.2 Subsidies

The largely unregulated existing ship breaking capacity in Asia has for some time now been in the spotlight for not adhering to even basic concerns for health, safety and environment. The market is very competitive on price and the industry has historically been seen to respond to increasing costs and legislative demands by moving the clusters of breakers to countries of low cost, higher demand for recycled steel and a lax enforcement of regulation.

Chapter 7 demonstrated that dismantling ships in a responsible way is associated with a reduced price for end-of-life ships. This means that under the current market conditions there are no incentives to EU ship owners to dismantle ships at a green facility. Unless instruments are developed and/or regulations are implemented and enforced to avoid this, the incentive will be to continue the current practices.

While in normal situations, EU subsidy of industry should be discouraged, it is vital that the EU find mechanisms and incentives to spark the industry. Therefore the subsidy instrument is treated in this section even though it might require amendments to the EU guidelines for environmental state aid as they currently do not include ship dismantling or pre-cleaning as eligible for state aid.

Also not considering the question of equity, i.e. who should bear the costs, using subsidies is the simplest way of making green recycling economically attractive. Moreover, subsidies can be used as a means to provide a sufficient incentive for ship owners to sell their ships to recycling facilities complying with the guidelines.

In chapter 7 the additional cost for the ship owner of three alternatives to conventional beaching was calculated. In the cheapest alternative, dismantling in Turkey, the ship owners' expected revenue is reduced by approx. 150 USD per LDT. The pre-cleaning scenario is expected to result in additional costs of 180-280 USD per LDT, while the scenario with full green dismantling results in additional costs of 250-400 USD per LDT.
In chapter 3 future scrapping volumes were estimated. Scrapping of vessels which today are both EU-flagged and EU-owned will amount to 1.1-1.8 million LDT/year, except for 2010, and EU-flagged vessels which are owned by non-EU countries will account for scrapping of 0.2-0.3 million LDT/year. On average from 2007-2020, EU-flagged scrapping will amount to 1.6 million LDT/year.

On this basis the theoretical level of subsidy needed to ensure that environmentally acceptable dismantling is competitive in relation to conventional beaching in Asia can be calculated.

**Table 8-1**  
*Estimated subsidy needed for ship dismantling in the three alternative scenarios until entry into force of new convention*

<table>
<thead>
<tr>
<th></th>
<th>Pre-cleaning scenario</th>
<th>Full green dismantling, EU</th>
<th>Full green dismantling, Turkey</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost difference to reference scenario (USD per LDT)</td>
<td>180 - 280</td>
<td>250 – 400</td>
<td>155</td>
</tr>
<tr>
<td>Scraping volume, all vessel types, EU flagged (LDT per year)</td>
<td></td>
<td>1,600,000</td>
<td></td>
</tr>
<tr>
<td>Total subsidy needed, 2007-2013</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>mill. USD per year</td>
<td>290-450</td>
<td>400-640</td>
<td>250</td>
</tr>
<tr>
<td>mill. EUR per year</td>
<td>214-333</td>
<td>296-473</td>
<td>185</td>
</tr>
</tbody>
</table>

Note: The calculated cost differences are associated with uncertainty and only provide the order of magnitude of the difference to the conventional beaching method.

China is not shown in the table, but it is estimated to resemble the case for Turkey.

The table above presents the total cost difference between continued uses of conventional beaching for EU-flagged ships and the alternative approaches analysed. It highlights that in total subsidies of approx. 250 million USD per year would be needed to provide sufficient incentive for ship owner to choose Turkish sites over Asian. A larger subsidy in the range of 290-450 m. USD per year would be needed to support the pre-cleaning alternative, whereas 400-640 m. per year would be needed to support full green dismantling in EU.

A subsidy scheme for “green” recycling should not apply indefinitely. Assuming that the proposed IMO draft Convention is approved and signed by the EU member states and possibly the EU as a Party, the entry into force of the Convention on Ship Recycling may at the earliest take place in 2013. At that time a level playing field will be established and no subsidies should be required. The promotion of and support for green recycling should be limited to the interim period up to the expected entry into force.
The subsidies could potentially take a number of different routes, e.g.:

- Support to the green facilities to facilitate capacity-building and increase their competitiveness, e.g. R&D, technical assistance, procurement of equipment.

- Direct subsidies to ship owners using green recycling.

- Direct subsidies to ship breakers to make them competitive.

- Tax benefits etc. to ship owners using green recycling.

The subsidy could be paid directly to ship owners choosing an approved green recycling facility. The subsidy needs to be of a size which makes the total benefit (subsidy plus price paid by the ship scrapper) of choosing a green recycling facility as high as choosing an existing non-complying facility.

Designing an efficient scheme with subsidies to ensure green dismantling of EU-flagged ships is associated with many challenges and potential pitfalls.

At the same time, the subsidy should be sufficient to make green dismantling competitive, yet it should not be so high that green facilities in EU/Turkey would become more attractive for the world's ship owners.

If the subsidy is too low dismantling in Asia will continue to prevail. On the other hand, if the subsidy is too high it could lead to an adverse problem of the world fleet being re-flagged to EU flags to enjoy high end-of-life ship values for scrapping at a green facility.

Deciding the appropriate level of subsidy is difficult and the numbers presented above are associated with substantial uncertainty and thus only provide the order of magnitude of the cost difference.

One way to avoid the problem of deciding the level of subsidy would be for EU to buy the ships at the market price, i.e. the price that breakers in Asia would be willing to pay. EU could then tender the dismantling of the vessels to the most competitive environmentally green facility in EU. The cost difference would be the level of the subsidy and would have to be covered by EU. At least from a theoretical point of view this would not only be an efficient way to ensure green dismantling, it would also avoid the problem of explicitly deriving the level of subsidy needed.

As an alternative to direct subsidies, grants could be given to ship dismantling facilities to provide capacity, i.e. grants to cover investments. Direct subsidies could potentially improve the present situation quickly by ensuring at least minimum "green" capacity for the dismantling of vessels.

While establishment of capacity is of course a necessary condition, it is not a sufficient condition to ensure that ships are dismantled at the green facility. Indeed, the most important cost driver is that of labour cost (an operating cost).
Therefore, even when investments are covered for green facilities in EU they will not be competitive to the facilities with low labour cost in Asia.

In a recent report by the French Secrétariat Général de la Mer (MIDN 2007) the costs of upgrading existing dismantling facilities in third world countries to a green recycling standard have been estimated to 50 to 150 USD per LDT (Annexe IX, p. 76). Hence, upgrading and using existing Third World country facilities could be economically more attractive than using green facilities in Europe (which would still have higher costs in the range of 150 to 300 USD per LDT).

**Existing national strategies**

Subsidies to any industry should generally be avoided unless special circumstances apply. However, unsafe and environmentally unfriendly conditions of ship dismantling in Asia could justify a certain degree of subsidy for an interim period until world wide regulation ensuring acceptable dismantling is in place.

The Commission has recently approved an Italian state aid programme for the breaking-up of single hull oil tankers. The scheme promotes scrapping of small single hull oil tankers over fifteen years old operating on the Italian cabotage (local) market. Shipping companies will be granted aid to break up their single hull oil tankers over fifteen years old intended for the transport of crude oil or petroleum or chemical products, and no conditions are attached to the subsidy with respect to the conditions of the recycling facility. The scheme will be in force for three years with an annual budget of €12 million.

The ships in question will be demolished instead of being transferred to less strict non-Community registers. In this way the measure anticipates the Community timetable and helps to improve shipping safety while protecting the marine environment. The Commission found that this measure boosts maritime transport safety without running counter either to the common interest or to European rules.

**8.4 Upgrading facilities outside the EU**

One of the claims of the shipping industry regarding the recycling industry is that it is not transparent to the ship owners which yards are actually complying with standards of safe and environmental sound ship recycling. One reason for this is of course that there is no coherent set of certifiable standards developed specifically for ship recycling, but instead in each country a number of regulations addressing worker’s health, environmental monitoring, waste, waste water etc. As stated above it may be appropriate to develop an internationally accepted base set of implementable and certifiable standards for green recycling facilities. If the IMO Convention eventually does make reference to standards for land-based facilities, these may be used already in the period up to entry into force for technical assistance projects, and if not, the guidance to the yards on how to comply with the demands of ship owners concerned with green recycling will be even more needed.
It is encouraging that a limited number of yards in Turkey, India and China have chosen to initiate a process towards green recycling under the prevailing market conditions and legislative environment, but very few have actually managed to buy vessels at a price reflecting the operating and capital costs of a green yard.

For the developing countries, the implementation of safe and environmentally sound ship recycling would necessitate investment in adequate waste reception facilities at the recycling yards, improved safety and health conditions for workers and environmentally sound waste management systems to ensure compliance with the appropriate recycling guidelines. These investments are not likely to be driven by the market demand. One solution could be to develop and promote globally a programme with a strategy for resource mobilization from donors such as the European Development Bank, EurAid, UNDP, the World Bank, Asian Development Bank, the Global Environment Facility, other (inter)national donor organisations and bilateral donors to give technical assistance to the facilities in third world countries.

It is therefore suggested that the following is taken into consideration:

- Inclusion of the issue in bilateral agreements with relevant countries to bring attention to the matter.
- Technical assistance to the development and implementation of national roadmaps to improved conditions in breaker yards.
- Assistance to the shipping industry, e.g. with development of certification/auditing schemes for green recycling facilities and lists of approved facilities.

The establishment of green recycling capacity for the merchant fleet is a task that must be driven primarily from the shipping and the recycling industry in response to the market, regulation or company policies. Obviously, the institutions of the EU may assist in capacity building, demonstration projects on upgrading in yards and trial vessels recycling. Therefore, the successful promotion of sound recycling practices in ship breaking nations may require mandatory international regulation and/or programmes designed to assist capacity development.

### 8.4.1 In EU candidate countries

Pre-accession programmes exist for assisting these countries in achieving compliance with the EU **acquis**. These funds are prioritised by the countries and the Commission and could for Turkey be a significant and fast way if establishing the regulatory compliance of the local ship recycling industry.

The ongoing improvements in Aliaga were initiated by the Turkish Shipbreaker’s Association and several yards, but authorities and industry appear committed to engage in activities to upgrade the local ship breaking industry.
8.4.2 In India and China

These countries do not accept assistance easily and do have the capacity to manage large investments. Assistance may be supplied through technical bilateral programmes.

Recently, the authorities in Gujarat Province have finalised a hazardous waste disposal facility that may service Alang and a programme for ISO certification. Thus, further capacity building for full environmental compliance should be well received. It should be noted that upgrading solely the environmental conditions of the yards will not result in acceptable conditions if the safety and health issues have not been addressed. No casualty statistics are available for ship recycling in China, but in Alang during 2003-2004 the official account of work-related fatal accidents were 26, although other sources claim there were 103 deaths due to a variety of accidents at the scrap yards. The Accident Frequency Rate (AFR) could serve to measure the actual safety standard at the facilities, as a lower number of accidents can be related to the fact that fewer ships are being scrapped.

8.4.3 Developing countries Bangladesh and Pakistan

There has been very little scrapping activity until late 2006 and little if any donor assistance to the Pakistani yards. In Bangladesh the ILO has carried out a capacity building project in the ship breaking yards of Chittagong. Conditions in the yards have not improved over recent years and with the presently steaming recycling market in Bangladesh which is now the largest ship scrapping nation, more workers than ever are employed and more steel import levies are collected for the government.

This means that probably more that half a million people in extended families depend on the industry for their living. The consequences of a sudden unmitigated enforcement of regulations on the scrapping activities would be catastrophic in the areas engaged in the beach breaking today.

With the upcoming peak in tanker phase-out volume Bangladesh will presumably be a prime destination for obsolete vessels.

Both Pakistan and Bangladesh are eligible for assistance from a number of donor sources, both bilateral and multilateral. Capacity building in terms of safe and environmentally sound management of ship recycling in yards and authorities may be needed and not least establishment of waste collection and hazardous waste facilities would help to advance the recycling conditions in these countries.

49 Casualty list, compiled by Tehelka, by cross-checking casualty figures with workers at the yards and at the shanties.
8.4.4 **Who should pay?**

As green recycling means extra costs this raises the question of who shall bear the costs for green recycling?

Should it be tax payer financed or should the costs be paid by the ship builders or the ships owners?

In the longer run it will properly not be acceptable for investment in clean dismantling of ships to be subsidised out of public funds. Hence, the objective should properly be to establish a sustainable funding system whereby ship-owners contribute at least partly to the safe and environmentally sound dismantling of ships worldwide.

For government vessels, where no additional regulations are needed for green dismantling to take place at facilities in Europe/Turkey, the cost (in terms of costs difference to the most economic attractive option of beaching in Asia) is covered directly by the ship owner. This follows a broad interpretation of the polluter pay principle as the industry itself finances the additional costs.

If the economic instrument of subsidy is used for the merchant fleet, costs are first put on the tax payers via the EU and/or its member states. However, a subsidy scheme could be supplemented by a financing mechanism, which would generate funding from the industry.

Financing could potentially be provided using a number of different options:

- Levies on the shipping industry.
- Tax on calling at a European port.
- Recycling fund with contributions to be paid at the new built phase.

Levies and taxes on the shipping industry to provide finance and cover the costs of a subsidy scheme in order to ensure green recycling could come in many different forms. Levies could be put on the new building phase but it could also be contributions during the lifetime of the vessel. Thus, for example recycling charges could be included in the insurance premium or they could be levied by the flag state.

Regardless of the form of taxes and levies, it is vital that a scheme is designed in such a way that it is not possible to escape by re-flagging of vessels or otherwise evading or bypassing the regulation. Therefore, due to the strongly global nature of the shipping industry, a financing scheme would most efficiently be implemented on international level.

If the EU adopts legislation on its own without support of the IMO, the range of possible efficient tax schemes is reduced significantly. For example levying the ship building industry would not be effective as construction could take place outside EU. In other words, introduction of poorly designed financing mechanisms would lead to circumvention of the rules and thus have no effect in relation to the objective of providing finance.
9 Recommendations

Since the 1960s the ship breaking industry has moved from the industrialised countries around the globe in search of competitive labour costs and fewer regulatory restrictions. The present efforts to reach a global agreement on ship recycling are, among other objectives, meant to result in an improvement of the current recycling practices, in particular in South Asia. It is likely that the international community will not tolerate yet another move of the ship breaking industry to utilise an even cheaper labour force unless acceptable standards of environment, health and safety regulations are enforced.

An IMO Convention is expected to enter into force at the earliest in 2013. Recommendations addressing the interim period are provided, but the recommendations mentioned below first address the basic interventions required of an international agreement in order to establish a viable market for safe and environmentally sound ship recycling;

Recommendations for the Convention and its implementation:

1. The success of the work towards an international agreement on ship recycling is of paramount importance for the creation of a level playing field. The IMO convention on ship recycling should include enforceable and adequate requirements and standards both for the ship owners, the ship recyclers and other actors in ship recycling.

2. Ship owners and other parties need to have clear and transparent information on the qualitative and quantitative capacity of ship recycling facilities. It is proposed that an internationally recognised classification, certification and audit system for recycling yards is created.

3. The flag states and recycling states should share information on the appropriateness and match of a ship according to its inventory of hazardous materials and the yard’s capabilities as described in the yard management plan or its international classification. It is proposed that a mechanism for exchange and evaluation of ship recycling plans is established, possibly with a third-party verification.
Particularly regarding pre-cleaning:

4. It is not clear what levels of hazardous substances are acceptable in a “properly emptied” vessel. It is proposed to compile existing quantitative standards and develop a test case for export of an actual vessel pre-cleaned to the “properly emptied” level.

5. The pre-cleaning of vessels to the level of compliance with the WSR, i.e. to the level of “properly emptied”, is generally thought to lead to a need for towing on the final voyage. It is proposed to investigate the possibilities of establishing EU-based or overseas pre-cleaning facilities servicing shipbreaking in Europe/Turkey or Asian yards respectively, thus minimising towing of hulls.

6. A self-propelled final voyage is the option preferred by the shipping industry since it allows for trading. This would rule out full pre-cleaning in the EU and if ship recycling is still to be carried out in Asia, under what conditions may an export of a vessel be acceptable? For this case it is proposed to develop a mechanism to establish the existence and use of appropriate dismantling and disposal technology in the final recycling country thus ensuring safe and environmentally sound management.

7. If a vessel still travels under its own power on the final voyage, another option would be to allow re-export of hazardous materials to the ship’s flag state or the country of ownership. The latter would still require existence and use of a mechanism for ensuring appropriate dismantling techniques. Both options (6 and 7) would require an amendment to the Basel Ban Amendment to allow more residual materials in a “properly emptied” vessel.

8. The above must obviously be followed by soft and hard capacity building in selected destinations for pre-cleaned vessels. Thus, it is proposed to assess a pilot case for export of a non-pre-cleaned vessel and treatment at the receiving yard, taking into account the need for acceptable dismantling procedures and disposal facilities.

During the interim period up to year 2013 (at the earliest) a number of measures could be considered to avoid re-flagging of old vessels and support the development of a market place for safe and environmental sound ship recycling. The promotion of and support for green recycling should be limited to the interim period up to the expected entry into force in 2013 where a viable market with a level playing field is established.

The possibilities of applying strong “command and control” in this area are limited due to the complexity of the shipping market, and other mechanisms must be brought into action. In the interim period, encouragement - ranging from political focus to subsidies - may be necessary to provide a market for the recycling of EU member state flagged vessels. It is estimated that the most incentives can be financed through existing mechanisms such as LIFE, regional...
development, pre-accession funds and possibly EuroAid and bilateral technical assistance agreements in the case of non-EU countries.

Other measures are suitable in particular for the phase leading up to the entry into force to encourage and prepare the shipping industry and the recycling industry for a sustainable future. These measures can also be invoked if an acceptable international agreement cannot be found or is delayed.

Recommendations for the interim period up to the Convention:

9. The volume of EU member state owned vessels is in itself insufficient to sustain any greater development of safe and environmentally sound recycling capacity. To concentrate the capacity it is suggested that tendering of obsolete vessels for scrapping is carried out at Community level. The tendering process could involve pre-qualifying yards followed by a tender amongst these yards on a vessel-by-vessel basis.

10. A few dedicated ship owners have initiated programmes to develop green recycling in selected yards. A comprehensive one-stop knowledge-sharing facility should be established involving yards, ship owners, local authorities and professional knowledge base, such as the classification societies and other consultants.

11. Awareness in the shipping community on acceptable facilities could be raised. The Commission could consider establishing a price in tandem awarded to an upgraded yard and a responsible ship owner, who successfully scrapped a vessel under appropriate conditions.

12. Both the single hulled tanker phase-out and a backlog in cargo vessels will lead to a peak of scrapping during the interim period, and there is no “official” recognition of yards offering safe and environmentally sound ship recycling. A fast track project should initiate the development of a European Community voluntary classification and labelling of member state facilities, accession countries, OECD/EFTA and other facilities, in particular those in Asia, claiming safe and environmentally sound ship recycling.

13. Owners and investors in existing or potential ship recycling facilities in EU member states and elsewhere will need access to one or more fully-fledged upgraded facilities to implement the improved standards without delays. It is proposed to establish a demonstration project for upgrading/certifying one or several recycling yard(s) in the EU, Turkey, China or India/Bangladesh, preferably with a demonstration vessel scrapped under full documentation.

14. In the interim period awareness should be raised concerning hazardous materials onboard. It is proposed that all existing vessels under EU member state flagged ships and ships calling at EU ports after a given date, e.g. January 1st 2010, must complete Part I of the In-
inventory of Hazardous Materials as developed by the IMO (Parts II and III must be completed for vessels before their final journey).

15. It has been challenging to prove ship owner’s intention to scrap. Raising awareness may also include training of EU port officials and other enforcement personnel in recognising the signs of a “to be scrapped” vessel.

16. The market will not develop a supply of green recycling facilities under the current demand conditions. The effectiveness of the Convention in ensuring this from 2013 (at the earliest) is unknown, but its success may be sparked during the interim period, where incentives should be invoked. Ship owners complying with the Convention and the WSR will experience costs presently ignored. An economic incentive programme may therefore increase and ensure the stability of the market conditions for the emerging green recycling facilities. Such incentive programme must rely on subsidies, which potentially could take a number of different routes, e.g.:

- Support to the green facilities to facilitate capacity and increase their competitiveness, e.g. R&D, technical assistance, procurement of equipment;
- Direct subsidies to ship owners using green recycling;
- Tax benefits etc. to ship owners using green recycling.

Designing an efficient scheme with subsidies to ensure green dismantling of EU flagged ships is associated with many challenges and potential pitfalls and must be evaluated separately.

The existing and future support for the development of safe and environmentally sound ship recycling may include some or all of the above mentioned interventions. It must be emphasised that in the globalised shipping industry the viable solution must be based on the generation of a level playing field, which in this case could be a strong and enforceable Convention on Ship Recycling aimed at the responsibilities of both ship owners and ship recyclers.
10 References


IMO MEPC 55/5/2 Report of Correspondence Group on Ship Recycling, submitted by Norway. 7 July 2006.

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Appendix A: Methodology for historical volume, current fleet and projected scrapping

Historical decommissioning volumes

This chapter describes the recorded scrapping activity from 1994-2006, with a special emphasis on the years 2004-2006.

Estimates of historical scrapping volumes (number of vessels, DWT and LDT) are provided by geographical regions and by ship type. The methodology applied is consistent to the COWI/TREN study and the predictions made in that study for the scrapping in 2004-2006 is compared to the actual scrapping in that period.

The assessment covers vessel types 1-8.

Methodology for analysis of historical developments

The methodology applied for the analysis of the historical decommissioning volumes is described below. This includes a description of data, segmentations, approximations and delimitations.

Data

The data on historical scrapping for 2004 to 2006 is from the Clarkson's Ship Register (July 2006), while data for the period 1994-2003 is taken from the COWI/TREN study, which was also based on data from Clarkson.

The information covers a wide range of information on all merchant ships; including type of vessel, size of vessel, place of scrap, scrap price etc.

The analysis of historical volumes includes vessels of 2,000 DWT and above. Vessels of less than 2000 DWT only contributes marginally to total volumes of scrap.

Segmentation

For analytical purposes, the scrapped vessels have been split into eight type segments. The segmentation is based on a categorisation of the "sub types" used in Clarkson's databases. For each segment, relevant size ranges have been defined. The details of the segmentation are shown in appendix 1.

For the analysis of the historical developments, no distinction is made between the hull types of oil tankers.

The details of the geographical segmentation are also provided in appendix 1.
Approximations
Historical volumes of ship demolition are estimated by number of vessels, DWT and LDT. For some of the scrapped vessels, information is not available on LDT. For these vessels, LDT is estimated on the basis of a unit conversion factor based on the DWT of the ship. A unit conversion factor is estimated for each segment and size range. The details of this are presented in appendix 2.

Methodology for analysis of future decommissioning volumes

The methodology applied for the statistical analysis of future decommissioning volumes is described below.

General

A number of factors influence the future supply of vessels to the ship scrapping industry including; the future earning potential, the cost of keeping the ship in operation, the age profile of existing fleet, the size of the current fleet, regulatory issues, budgets etc.

Three different approaches

Different approaches are used for forecasting the future scrapping volumes as the importance of these factors differs by vessel type and because some vessels are subject regulation.

Three different approaches are applied here:

d) Vessel type 1, Single hull oil tankers: Single hull oil tankers are assumed to be scrapped in accordance with the latest phase-out schemes (EC regulation No. 1726/2003 of 22 July 2003 and Revised Annex 1 of MARPOL of 2003).

e) Vessel type 2-9: These vessels are operating on commercial conditions and are not subject to phase-out regulation. Future volumes of scrapping will among other things depend on the age profile of the existing fleet, the future earning potential and the costs of regulation (see section below for special comments on fishing vessels).

f) Vessel type 10, Warships: EU warships are obviously not operating on commercial conditions. Decisions on whether to scrap a vessel or not is determined on the basis of the costs of keeping the vessel operating, the need for warships, political arguments, available budget etc. Future scrapping volumes of warships are therefore very hard to forecast. When assessing the future volumes of scrapping of warships it is simply assumed the all warships aged 25 or more will be scrapping during the next 14 years (2007-2020).
Size limits
The analysis focuses on vessels of 2,000 DWT and above for vessel type 1-8, fishing vessels of 500 GT and above\(^50\) and warships of 150 LDT and above.

Country grouping
The projections of the future volumes of scrapping are made by flag state and country of ownership on the basis of the following definition:

c) **EU countries**: The 27 EU Member States.

d) **Non-EU countries**: All other countries (including accession countries).

This implies that projections are made for 4 categories:

- **EU flag/EU owned**
- **EU flag/Non-EU owned**
- **Non EU-flag/EU owned**
- **Non EU-flag/Non-EU owned**

The analysis covers the global fleet of vessel types 1-5 and 7-8, but only fishing (vessel type 9) and naval vessels (vessel type 10) which are flying the flag of an EU Member State and passenger vessels (vessel type 6) sailing to and/or from and EU country.

The country of ownership for vessel types 1-5 and 7-8 is identified on the basis of the information provided in the Clarkson database\(^51\).

It has not been possible to determine the country of ownership directly for passenger ships. Instead it is assumed by looking at the vessels on each route in EU, that half the vessels are owned by the country of origin and half by the country of destination. The information on flag state and route specific information is based on data from Shippax ‘Statistics and Outlook 06’.

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\(^50\) The upper interval of vessels eligible for scrapping premiums in the EU exit scheme for fisheries, EC 2792/1999 is 500 GRT. Since in most cases the GT of a vessel is greater than its GRT slightly more vessels are included compared to the number of vessels subject to the EU exit scheme.

\(^51\) Please note the following statement from Clarkson: "The term "Owners" within this product is used as a simplified term for "Primary Reference Companies". The Primary Reference Company is defined as the company with the main commercial responsibility for the ship and can be Owner, Manager, Agent or other associated company. None of the information contained in this product is intended to confirm or otherwise the legal status of the companies or the ships associated with them."
Vessel type 1 - Single hull oil tankers

The analysis of the consequences of the phase-out regulation for single hull oil tankers is a complex matter due to the complexity of the regulation, but also due to the limited information available. Hence, simplifications and assumptions are necessary when analysing the impact of the regulation. The assumptions and delimitations made are described here.

It is important to note that single hull tankers consist of both single skin oil tankers (SS) and oil tankers equipped with double sides (DS) or double bottom (DB). The regulation does distinguish between these in terms of year of phase-out.

Single hull tankers are assumed to be phased out in accordance with EC regulation No. 1726/2003 of 22 July 2003 and Revised Annex 1 of MARPOL of 2003.

Three categories of single hull oil tankers

First of all, simplifications are necessary when dividing the ships into the three categories identified in the regulation:

- **Category 1:** This category covers single hull tankers over 20,000 DWT carrying crude oil, fuel oil, heavy diesel oil or lubricating oil as cargo, and of single hull tankers over 30,000 DWT carrying oil other than the above, which do not comply with the requirements for protectively located segregated ballast tanks. As the information on whether a given vessel complies with the requirements for protectively located ballast tanks is not available and the information on type of cargo is only indirectly covered, it is necessary make simplifications. Accordingly, for practical purposes this segment has been defined as single hull oil tankers over 20,000 DWT built in 1981 or earlier.

- **Category 2:** This category covers single hull tankers over 20,000 DWT carrying crude oil, fuel oil, heavy diesel oil or lubricating oil as cargo, and of single hull tankers over 30,000 DWT carrying oil other than the above, which do comply with the requirements for protectively located segregated ballast tanks. Due to the above mentioned limitations of the data material, this segment has been defined as single hull oil tankers over 20,000 DWT built in 1982 or after.

- **Category 3:** This category covers single hull oil tankers over 5,000 DWT, but less than specified under the two first categories. In line with the above, this segment has been defined as single hull oil tankers between 5,000 DWT and 20,000 DWT. For some of the vessels in this category, no indications are available on the hull type. In the analysis these vessels are treated as single skins.

It is noteworthy that the implications for the results of not taking into account the 20,000/30,000 DWT limits are small, as less than 5% (measured as DWT) of oil tankers are between 20,000 and 30,000 DWT.
Assumptions and delimitations

The assumptions and delimitations made in relation to the projections are listed below:

- Special rules relating to vessels between 600 DWT and 5,000 DWT have not been taken into account, i.e. only single hull oil tankers above 5,000 DWT have been included in the analysis (single hull oil tankers under 5,000 DWT are treated as other tankers).

- The analysis takes into account the special rules for oil tankers of category 2 or 3 equipped with double sides or double bottoms. It is assumed that these will continue to be operated until 2015 or the year in which the ship reaches the age of 25, whichever is sooner. It is assumed that all oil tankers listed as double bottom/double side comply with the requirements listed in the regulation.

- It is assumed that all phased out ships are dismantled, which means that it has been assumed that these are not used for any other purpose at the end of their trading life. In reality under IMO 13G, tankers are rebuilt to serve as, for example, FPSOs (floating production storage and off-loading) or FSOs (floating storage and off-loading).

- The relevant EC 1726/2003 regulation is only applicable for European countries. However, the newly adopted Revised IMO MARPOL 13G regulation, which is almost similar to the EC 1726/2003 regulation, is applicable world wide. Accordingly, it is assumed in the main analysis that the EC 1726/2003 applies for all vessels. Note that there are a few important differences between in the EC 1726/2003 regulation and the Revised IMO MARPOL 13G regulation, which are ignored in the main analysis:
    - The date of entry force in the EC and IMO regulation differs. It is assumed that all single hull tankers are phased out according to the EC date of entry into force.
    - In the IMO regulation, tankers can be exempted from the phase out dates if certain conditions are fulfilled. It is very difficult to predict how much this exemption will be used. Therefore, for analytical purposes it has simply been assumed that it is not used by the ship owners.

- It is assumed that single hull oil tankers are sold for demolition at the dates specified under the relevant regulation. In reality, the market forces might imply that the ship owners decide to supply some of their vessels to ship scrappers before that date. The above mentioned exemptions e.g. for vegetable or light oils, will give a discrepancy observed as an extended average age of the fleet.

- The consequences of the new regulation relating to the tankers carrying heavy grade of oil have not been analysed. Possible implications would be very difficult to project and the results would heavily depend on assumptions that would have to be made in order to analyse the impacts.
• Tankers fulfilling the conditions in paragraph 1(c) of 13G are considered as double hulls. This means that this special condition exempting tankers fulfilling specific requirements for minimum distances between the cargo tank boundaries and the ship side and bottom plating has not been taken into account in the analysis.

The assessment for vessel type 1 is made on the basis of information from the Clarkson database.

**Vessel types 2-9**

The future volumes of scrapping of vessel types 2-9 depend, as mentioned previously, on a large number of factors, which however cannot be taken into account when projecting the future volumes of scrapping.

The estimates of the future decommissioning volumes of vessel types 2-9 are therefore prepared on the basis of the *estimated life time expectancy and the age profile of the current fleet*. Practically, the estimates are the results of a four step procedure:

a) The *age profile* of the existing fleet for each shipping segment is estimated.

b) The *decommissioning frequency function*, which shows the share of vessels scrapped at a certain age, is estimated for each segment. For statistical analysis, the decommissioning frequency function is estimated on the basis of a three-parameter Weibull fit by varying the mean value for each segment in accordance with the average lifetime observed historically\(^{52}\).

c) The *conditional decommissioning frequency function* is estimated on the basis of the decommissioning frequency function. The conditional decommissioning function expresses the probability that a vessel is scrapped in the following year conditional on being in operation at the beginning of the year.

d) Combining the estimated age profile and the conditional decommissioning frequency function for each segment, estimates of the future decommissioning volumes are obtained. By adding these for all segments, the aggregate estimates of future volumes of scrapping are reached.

It should be noted that by applying the approach described above of estimating the future decommissioning volumes by year (e.g. when ships are scrapped), the projections will only reflect the overall trend in volumes. Moreover, the projections will not reflect e.g. the ups and downs of the scrapping market business cycle that comes from fluctuating freight rates and future political initiatives to adjust the fleet of fishing vessels and warships. However, using the

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\(^{52}\) The Weibull distribution is widely used in reliability and life data analysis due to its versatility. Depending on the values of the parameters, the Weibull distribution can be used to model a variety of life behaviours.
estimated age profile and the fitted conditional decommissioning frequency function to estimate the future decommissioning volumes the trend in the medium and long term will be reflected.

The assessment for vessel types 2-5 and 7-8 is made on the basis of information from the Clarkson database, while the projections for fishing vessels (vessel type 9) are based on the Community Fleet Register.

The information for passenger vessels is obtained from Shippax. The fleet analysis of passenger vessels (and Ro-Ro) only covers vessels, which are sailing to and/or from an EU country. In case a vessel is sailing between an EU and a non-EU country it is included with a weight of 50%.

**Specific comments on fishing vessels**

The European Community fishing fleet is tightly regulated by EC legislation and as such future decommissioning volumes are subject to regulatory changes. In the calculations of the forecast of future volumes of scrapped vessels it is assumed that the current legislative framework is unchanged.

The main regulations which might affect future decommissioning volumes are the Entry-Exit scheme and the Reference level framework. The latter states that the total capacity of the fleet of each member state (does not apply to the Member States that joined the EU on the 1 May 2004) cannot exceed the reference level in terms of either power or tonnage. The levels are based on the global final objectives of MAGP IV as established by article 12 of Council Regulation 2371/2002. The current reference levels have very limited practical effect, though, because the fleets of most Member States are already below their reference levels.

The current Entry-Exit scheme was put in effect by 1 January 2003, and applies to the capacity of the fleets in terms of both power and tonnage. It states that entry into the fleet should be compensated by at least an equivalent reduction from the fleet. Furthermore, capacity leaving the fleet with public aid cannot be replaced, thus permanently reducing the maximum size of the fleet. The entry-exit scheme is regulated by Article 13 of Council Regulation 2371/2002 and Article 6 and 7 of Commission Regulation 1438/2003.

The historically observed decommissioning volumes of fishing vessels cannot be used for estimating future decommissioning volumes as the historical levels have been greatly influenced by past regulation. The decommissioning frequencies function for non-cargo vessels is used instead, as they are the most similar vessel type.

The database on fishing vessels does only include the weight of the vessels in GT. In order to present the scrapping volumes in LDT all figures have been converted using an estimated conversion factor for non-cargo vessels corresponding to the weight in LDT equalling 54% of the GT.

The analysis does, as mentioned previously, only include fishing vessels of 500 GT and above.
Vessel type 10 - Warships

The future volumes of warships to be scrapped depend on the costs of keeping the vessel operating, the need for warships, political arguments, available budgets etc.

Data on European warships are obtained from Jane's Fighting Ships, Yearbook 2006-2007. It is one of the most detailed sources of information on military fleets. Further, it also includes a range of vessels used for non-military operations and owned by European Member States and their subsidiaries. This includes custom boats, icebreakers, survey and research ships, tugs etc., but not ferries owned by state-controlled companies. The details covered in Jane's Fighting Ships are fewer for small boats not used for military operations. The analysis of warships does not include small boats of a size less than 150 LDT.

Training boats (often sail boats) has been excluded from the analysis as well, because they are small and seldom are decommissioned before having been 40 years in service.

The database on warships does only include the weight of the ships in LDT for a very limited number of ships. The weight in terms of "full load displacement" is however available for all warships.

In order to present the scrapping volumes in LDT all figures has been converted from full load displacement to LDT using an estimated standard conversion factor.

The term full load displacement refers to the weight of the ships when it is fully loaded with all stores, ammunition, fuel and water, which is basically the sum of the ships LDT and its DWT.

The information for the few warships which had both the information of the weight fully loaded and the weight in LDT indicates an average factor of 58% (ranging from 47% to 82%). The comparable figure for "other non-cargo vessels", which most likely are the most similar vessel types, indicates an average factor of 46%.

In the following the weight in LDT has been estimated using a factor of 58% of the weight of the fully loaded ships.

When assessing the future volumes of scrapping of warships it is simply assumed that all warships aged 25 or more will be scrapped during the next 14 years (2007-2020).
### Appendix B: Status and projections for European end-of-life ships until 2020

**Table B**  
*Future volumes of demolition from COWI/TREN study, All types, Accelerated phase-out scheme for oil tankers (Million LDT)*

<table>
<thead>
<tr>
<th>Phase out year</th>
<th>Other tanker</th>
<th>Bulk carrier</th>
<th>Container</th>
<th>Gas</th>
<th>Passenger/ro-ro/vehicle</th>
<th>Other cargo vessel</th>
<th>Non-cargo vessel</th>
<th>Oil tanker</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2004</td>
<td>0.2</td>
<td>3.5</td>
<td>1.0</td>
<td>0.3</td>
<td>1.2</td>
<td>2.3</td>
<td>0.2</td>
<td>1.5</td>
<td>10.2</td>
</tr>
<tr>
<td>2005</td>
<td>0.2</td>
<td>3.2</td>
<td>1.0</td>
<td>0.3</td>
<td>1.0</td>
<td>1.9</td>
<td>0.1</td>
<td>0.1</td>
<td>7.8</td>
</tr>
<tr>
<td>2006</td>
<td>0.2</td>
<td>3.0</td>
<td>0.9</td>
<td>0.3</td>
<td>0.9</td>
<td>1.6</td>
<td>0.1</td>
<td>0.2</td>
<td>7.2</td>
</tr>
<tr>
<td>2007</td>
<td>0.2</td>
<td>2.9</td>
<td>0.9</td>
<td>0.3</td>
<td>0.8</td>
<td>1.4</td>
<td>0.1</td>
<td>0.3</td>
<td>6.9</td>
</tr>
<tr>
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<td>0.2</td>
<td>2.8</td>
<td>0.9</td>
<td>0.3</td>
<td>0.7</td>
<td>1.3</td>
<td>0.1</td>
<td>1.3</td>
<td>7.6</td>
</tr>
<tr>
<td>2009</td>
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<td>2.7</td>
<td>0.9</td>
<td>0.3</td>
<td>0.7</td>
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<td>1.1</td>
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</tr>
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<td>11.0</td>
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</tr>
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<td>0.3</td>
<td>0.5</td>
<td>0.9</td>
<td>0.1</td>
<td>0.4</td>
<td>5.9</td>
</tr>
<tr>
<td>2012</td>
<td>0.4</td>
<td>2.3</td>
<td>1.0</td>
<td>0.2</td>
<td>0.4</td>
<td>0.8</td>
<td>0.1</td>
<td>0.3</td>
<td>5.5</td>
</tr>
<tr>
<td>2013</td>
<td>0.5</td>
<td>2.2</td>
<td>1.1</td>
<td>0.2</td>
<td>0.4</td>
<td>0.8</td>
<td>0.1</td>
<td>0.4</td>
<td>5.7</td>
</tr>
<tr>
<td>2014</td>
<td>0.6</td>
<td>2.1</td>
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<td>0.0</td>
<td>1.2</td>
<td>6.6</td>
</tr>
</tbody>
</table>

Source: COWI/TREN study, pp. 82 and 84
Figure B-1  Total historical ship scrapping volumes 1994-2003, all types by region (share of LDT). The term “Indian sub-continent” is used by Clarkson to denote vessels with an unspecified destination in India, Bangladesh or Pakistan.
Table C  The fleet of single hull oil tankers by category, hull type and year of delivery (Million LDT)

<table>
<thead>
<tr>
<th>Build year</th>
<th>CAT 1 DB/DS</th>
<th>SS</th>
<th>Total</th>
<th>CAT 2 DB/DS</th>
<th>SS</th>
<th>Total</th>
<th>CAT 3 DB/DS</th>
<th>SS/missing</th>
<th>Total</th>
</tr>
</thead>
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<td>Pre 1970</td>
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</tr>
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<td>0.0</td>
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<td>0.0</td>
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</tr>
<tr>
<td>1993</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.2</td>
<td>1.1</td>
<td>1.3</td>
<td>0.0</td>
<td>0.0</td>
<td>1.4</td>
</tr>
<tr>
<td>1994</td>
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<td>0.0</td>
<td>0.7</td>
<td>0.8</td>
<td>0.0</td>
<td>0.0</td>
<td>0.8</td>
</tr>
<tr>
<td>1995</td>
<td>0.0</td>
<td>0.0</td>
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<td>0.0</td>
<td>0.5</td>
<td>0.6</td>
<td>0.0</td>
<td>0.0</td>
<td>0.6</td>
</tr>
<tr>
<td>1996</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.1</td>
<td>0.1</td>
<td>0.0</td>
<td>0.0</td>
<td>0.1</td>
</tr>
<tr>
<td>1997</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>1998-</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Total</td>
<td>1.0</td>
<td>2.3</td>
<td>3.3</td>
<td>3.5</td>
<td>10.8</td>
<td>14.3</td>
<td>0.8</td>
<td>1.3</td>
<td>2.2</td>
</tr>
</tbody>
</table>
Table D  Future volumes of demolition by vessel type and year of scrap - Vessel type 1-10 (Million LDT)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Single hull oil tanker</td>
<td>1.0</td>
<td>1.9</td>
<td>1.8</td>
<td>11.5</td>
<td>1.2</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
<td>1.2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>19.8</td>
</tr>
<tr>
<td>2. Other tanker</td>
<td>0.2</td>
<td>0.2</td>
<td>0.2</td>
<td>0.2</td>
<td>0.2</td>
<td>0.2</td>
<td>0.3</td>
<td>0.4</td>
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<td>0.6</td>
<td>0.3</td>
<td>0.3</td>
<td>0.3</td>
<td>0.6</td>
<td>6.8</td>
</tr>
<tr>
<td>3. Bulk carrier</td>
<td>3.7</td>
<td>3.3</td>
<td>3.1</td>
<td>2.9</td>
<td>2.8</td>
<td>2.6</td>
<td>2.5</td>
<td>2.3</td>
<td>2.2</td>
<td>2.1</td>
<td>2.1</td>
<td>2.1</td>
<td>2.2</td>
<td>2.2</td>
<td>36.1</td>
</tr>
<tr>
<td>4. Container</td>
<td>1.2</td>
<td>1.1</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
<td>1.1</td>
<td>1.1</td>
<td>1.2</td>
<td>1.3</td>
<td>1.4</td>
<td>1.6</td>
<td>1.8</td>
<td>16.9</td>
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<tr>
<td>5. Gas</td>
<td>0.3</td>
<td>0.3</td>
<td>0.3</td>
<td>0.3</td>
<td>0.3</td>
<td>0.3</td>
<td>0.2</td>
<td>0.3</td>
<td>0.2</td>
<td>0.2</td>
<td>0.2</td>
<td>0.2</td>
<td>0.2</td>
<td>0.2</td>
<td>3.4</td>
</tr>
<tr>
<td>6. Passenger/ro-ro/vehicle</td>
<td>0.8</td>
<td>0.6</td>
<td>0.5</td>
<td>0.4</td>
<td>0.3</td>
<td>0.3</td>
<td>0.2</td>
<td>0.3</td>
<td>0.2</td>
<td>0.2</td>
<td>0.2</td>
<td>0.2</td>
<td>0.2</td>
<td>0.2</td>
<td>4.5</td>
</tr>
<tr>
<td>7. Other cargo vessel</td>
<td>2.4</td>
<td>1.9</td>
<td>1.7</td>
<td>1.4</td>
<td>1.3</td>
<td>1.1</td>
<td>1.0</td>
<td>0.9</td>
<td>0.8</td>
<td>0.7</td>
<td>0.7</td>
<td>0.7</td>
<td>0.7</td>
<td>0.7</td>
<td>15.9</td>
</tr>
<tr>
<td>8. Non-cargo vessel</td>
<td>0.2</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>1.0</td>
</tr>
<tr>
<td>9. Fishing vessels</td>
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<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
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<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.7</td>
</tr>
<tr>
<td>10. Warships</td>
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<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
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<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.4</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>9.9</td>
<td>9.5</td>
<td>8.6</td>
<td>17.9</td>
<td>7.2</td>
<td>6.1</td>
<td>5.8</td>
<td>5.6</td>
<td>6.4</td>
<td>5.2</td>
<td>5.2</td>
<td>5.6</td>
<td>6.0</td>
<td>6.5</td>
<td>105.6</td>
</tr>
</tbody>
</table>
### Table E  
*Future volumes of demolition by owner/flag state and year of scrap - Vessel type 1-10 (Million LDT)*

<table>
<thead>
<tr>
<th>Phase-out year</th>
<th>EU flag/ EU owned</th>
<th>EU flag/ Non-EU owned</th>
<th>Non EU-flag/ EU owned</th>
<th>Non EU-flag/ Non-EU owned</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007</td>
<td>1.8</td>
<td>0.2</td>
<td>1.9</td>
<td>6.0</td>
<td>9.9</td>
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<td>2008</td>
<td>1.6</td>
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<td>1.9</td>
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<td>9.5</td>
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<td>2009</td>
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<td>0.2</td>
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<td>5.1</td>
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<tr>
<td>2010</td>
<td>2.4</td>
<td>0.3</td>
<td>3.1</td>
<td>12.0</td>
<td>17.9</td>
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<tr>
<td>2011</td>
<td>1.3</td>
<td>0.2</td>
<td>1.5</td>
<td>4.1</td>
<td>7.2</td>
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<tr>
<td>2012</td>
<td>1.2</td>
<td>0.2</td>
<td>1.3</td>
<td>3.4</td>
<td>6.1</td>
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<tr>
<td>2013</td>
<td>1.1</td>
<td>0.2</td>
<td>1.3</td>
<td>3.3</td>
<td>5.8</td>
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<td>2014</td>
<td>1.1</td>
<td>0.2</td>
<td>1.1</td>
<td>3.2</td>
<td>5.6</td>
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<tr>
<td>2015</td>
<td>1.2</td>
<td>0.3</td>
<td>1.3</td>
<td>3.7</td>
<td>6.4</td>
</tr>
<tr>
<td>2016</td>
<td>1.1</td>
<td>0.2</td>
<td>1.0</td>
<td>2.9</td>
<td>5.2</td>
</tr>
<tr>
<td>2017</td>
<td>1.1</td>
<td>0.2</td>
<td>1.0</td>
<td>2.9</td>
<td>5.2</td>
</tr>
<tr>
<td>2018</td>
<td>1.2</td>
<td>0.2</td>
<td>1.1</td>
<td>3.2</td>
<td>5.6</td>
</tr>
<tr>
<td>2019</td>
<td>1.3</td>
<td>0.2</td>
<td>1.1</td>
<td>3.4</td>
<td>6.0</td>
</tr>
<tr>
<td>2020</td>
<td>1.5</td>
<td>0.2</td>
<td>1.2</td>
<td>3.6</td>
<td>6.5</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>19.4</strong></td>
<td><strong>3.1</strong></td>
<td><strong>20.6</strong></td>
<td><strong>62.5</strong></td>
<td><strong>105.6</strong></td>
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</tbody>
</table>
## Appendix C: List of “green” ship recycling facilities

### Active ship dismantling facilities with a capacity of more than 20,000 LDT/year

<table>
<thead>
<tr>
<th>Country</th>
<th>Facility</th>
<th>Status</th>
<th>Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Belgium</td>
<td>Van Heyghen Recycling S.A.</td>
<td>Recycling of ships, previously mostly fishing vessels and coasters but are now looking also to scrap naval vessels. The yard has recently been inspected by the English and French navy but so far no response in relation to scrapping of navy vessels from the two countries.</td>
<td>Currently scrapping around 40-50 vessels a year. Capacity is up to 60,000 LDT/year</td>
</tr>
<tr>
<td>The Netherlands</td>
<td>Scheepssloperij Nederland B.V.</td>
<td>Currently dismantling smaller vessels of around 50 - 150 LDT. Recently they dismantled two Dutch Navy Ships as well as the Pacific Cruise ship and a sister vessel.</td>
<td>Capacity is 30,000 LDT/year.</td>
</tr>
<tr>
<td>Italy</td>
<td>Simont S.p.a</td>
<td>In operation, but mainly industrial demolition. Have not scrapped vessels since 1999. The facility has recently been inspected by a representative from the French naval commando in order to assess whether the facility would be suitable for scrapping the Clemenceau. Current waste management problems in the Naples region may cause administrative obstacles for the scrapping of non-Italian ships.</td>
<td>Capacity is 80,000 LDT/year.</td>
</tr>
<tr>
<td>Denmark</td>
<td>Fornaes ApS</td>
<td>Currently dismantling approx. 50 vessels a year mostly fishing vessel, small single hull tankers. They can accept ships of up to 130 meters at their facility in Grenaa.</td>
<td>Capacity is 25,000 – 30,000 tons of steel a year</td>
</tr>
<tr>
<td>Poland</td>
<td>Gdansk ship-yard.</td>
<td>Several naval vessels, including the destroyer &quot;Warszawa&quot; were dismantled there in the last years.</td>
<td>Not known</td>
</tr>
</tbody>
</table>
## Ship dismantling facilities for smaller vessels

<table>
<thead>
<tr>
<th>Country</th>
<th>Type</th>
<th>Description</th>
<th>Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lithuania</td>
<td>Several yards</td>
<td>The French Interministerial Working Group inspected several yards with various levels of experience and capacity for green recycling: Klapeidos Laivu Remontas, Klaipeda Kuusakoski, Klaipeda Subare, Klaipeda</td>
<td>Not known</td>
</tr>
<tr>
<td>Latvia</td>
<td>Several yards</td>
<td>The French Interministerial Working Group inspected several yards with various levels of experience and capacity for green recycling: Liepajas Metalurgs, Liepaja Kuusakoski, Riga</td>
<td>Not known</td>
</tr>
<tr>
<td>The Netherlands</td>
<td>HKS Metals 's Gravendeel</td>
<td>Operates a slipway (demolition ramp) and pier-breaking facilities. Mainly inland water vessels, but up to 4,000 LDT and 5 m draught</td>
<td>Not known</td>
</tr>
<tr>
<td>Poland</td>
<td>Various locations</td>
<td>150 fishing vessels were recently scrapped in various locations along the Baltic coast (Gdańsk, Gdynia, Władysławowo, Kolobrzeg, Dziwnów).</td>
<td>Not known</td>
</tr>
<tr>
<td>Denmark</td>
<td>Jatop ApS</td>
<td>Started dismantling ship at the facility in Frederikshavn three years ago. During those years their capacity has been increasing. Maximum tonnage for dismantling is around 2500 LDT.</td>
<td>Capacity is currently around 7,000-8,000 tons of steel a year</td>
</tr>
<tr>
<td>Denmark</td>
<td>Smedegaarden</td>
<td>Currently dismantling fishing vessels, small cargo ships and supply boats. Vessels no larger than 140-150 meters and 8 meters draught.</td>
<td>Capacity is approx. 15,000 – 20,000 tons of steel a year</td>
</tr>
<tr>
<td>Bulgaria</td>
<td></td>
<td>Two facilities operate at Varna and Bourgas, but only recycle smaller vessels</td>
<td>Not known</td>
</tr>
<tr>
<td>Spain</td>
<td>Desguaces de la Arena (Soto del Barco).</td>
<td>Dismantling of vessels up to 220 m length possible. Several other yards for smaller ships exist along the Northern coast of Spain.</td>
<td>Not known</td>
</tr>
<tr>
<td>Greece</td>
<td>Bacopoulos</td>
<td>Biggest facility for ship scrapping in Greece. They are dismantling smaller ferries, fishing and naval vessels.</td>
<td>Capacity 2,500 tones of steel a year</td>
</tr>
<tr>
<td>Greece</td>
<td>Savvas Pireus</td>
<td>So far no contact attempts have been successful. According to the Bacopoulous yard the facility is smaller than Bacolpoulos.</td>
<td>Not known</td>
</tr>
</tbody>
</table>
## Ship dismantling facilities under establishment

<table>
<thead>
<tr>
<th>Country</th>
<th>Facility</th>
<th>Status</th>
<th>Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>UK</td>
<td>Able UK TEERC</td>
<td>No ship scrapping activities yet since recently the Local Planning Committee refused the planning permission for the extension of facility. An appeal against the refusal has been submitted. The facility has received a waste permit from the EPA and after a lengthy planning procedure the remaining permits are expected in the near future.</td>
<td>When fully operational up to 600,000 LDT/year</td>
</tr>
<tr>
<td>UK</td>
<td>Harland and Wolf, Belfast Shipyard</td>
<td>Has joined forces with Golder Associates Ltd. in order to develop marine vessel and offshore structure recovery and recycling services. Applied for waste management license, but has not yet received it. Currently negotiating with MOD about decommissioning two naval vessels of about 6500 tones of steel. Belfast shipyard has the largest dry docks in Europe of 120 mill. DWT, but yet no experience with dismantling of ships.</td>
<td>Applied for 300,000 LDT/year</td>
</tr>
<tr>
<td>UK</td>
<td>A&amp;P Tyne, Hebburn</td>
<td>The existing repair yard is seeking permission to scrap six vessels annually in association with BAE Systems.</td>
<td>Not known</td>
</tr>
<tr>
<td>France</td>
<td>Bartin Recycling and Europlasma</td>
<td>Bartin Recycling, known from its activity in recycling airplanes, and the company Europlasma have formed a consortium to recycle ships, in particular the aircraft carrier Clemenceau.</td>
<td>Not known</td>
</tr>
<tr>
<td>Lithuania</td>
<td>Undoris JSC</td>
<td>Intend to expand its services to recycling of marine constructions and ship but so far no ships have been scrapped</td>
<td>Not known</td>
</tr>
</tbody>
</table>
EU and European OECD yards active until recently

<table>
<thead>
<tr>
<th>Country</th>
<th>Facility</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Norway</td>
<td>Lyngdal Recycling</td>
<td>The Bergen site has a dry dock that could be used for dismantling of ships but they have not dismantled any ships recently.</td>
</tr>
<tr>
<td>The Netherlands</td>
<td>Shipdock B.V. (Former Amsterdam Ship Repair)</td>
<td>No ship dismantling is presently taking place at their site and there are no plans to do so in the future. Amsterdam ship repair carried out the Sandrien dismantlement and this company has since been sold to Shipdock B.V.</td>
</tr>
<tr>
<td>UK</td>
<td>Swan Hunter Shipyard</td>
<td>The yard is closing down including the decommissioning site. The plan was to start decommissioning ships but the yard is set to close down in July of 2006.</td>
</tr>
</tbody>
</table>

The Ecodock planned for Eemshaven in the Netherlands did not open for business in 2006. The prospects for realization of the yard could not be clarified.
Facilities for decommissioning of offshore structures in EU and European OECD

<table>
<thead>
<tr>
<th>Country</th>
<th>Facility</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>UK</td>
<td>Shetland Decommissioning Company Ltd.</td>
<td>Have joined forces with Veolia and Aker Kvaerner for decommissioning of off shore structures at their site in Greenhead of a BP contract that Aker won. Currently they do not have the facilities for scrapping ships at the Greenhead site. Scrapping would have to be pier breaking and therefore management of environmental issues would have to be used.</td>
</tr>
<tr>
<td>Scotland</td>
<td>KBR Caledonia, Nigg</td>
<td>Existing offshore constructions yard with large wet/dry dock.</td>
</tr>
<tr>
<td>Norway</td>
<td>Aker Stord</td>
<td>Decommissioning off shore structures. No facilities for dismantling ships. Their market is off shore structures and therefore no focus on dismantling of ships.</td>
</tr>
<tr>
<td>Norway</td>
<td>Norsk Metallretur Offshore Recycling AS</td>
<td>Decommissioning off shore structures. Previously the company did dismantle ships. First period was until the 1970’s and second period from 1990 to 2000. However, they no longer dismantle ships as they cannot compete with Asia if it has to be done environmentally responsible.</td>
</tr>
<tr>
<td>Norway</td>
<td>AF Decom AS</td>
<td>In operation since 2005 and are currently decommissioning offshore platforms. Their facility is not suitable for scrapping bigger ships.</td>
</tr>
</tbody>
</table>
Ship dismantling facilities outside EU and European OECD with internationally recognized certifications

During 2006 there were seven ship recycling facilities operating in the USA located in Brownsville, Texas; New Orleans, Louisiana, Norfolk, Virginia and Baltimore, Maryland. The USA is not a Party to the Basel Convention, and the import would fall under the Toxic Substances Control Act (TSCA), which also prescribes a pre-notification. Due to national legislation and policy the yards are currently not open to foreign ships.

A facility in Canada, International Marine Salvage, Inc., in Port Colborne, Ontario, is also certified as to the performance regarding health and environment. It should be recalled that any ocean going ship would have to be able to pass through the locks of the Welland Canal (Lake Ontario to Lake Eire) to get to Port Colborne.

The facilities in China have obtained certification from the several agencies, including the Chinese National Standardisation Agency.

<table>
<thead>
<tr>
<th>Country</th>
<th>Facility</th>
<th>Annual recycling capacity LDT</th>
<th>Certification</th>
<th>Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>China</td>
<td>Jiangjin Changjiang Xiangang Ship breaking Company</td>
<td>&gt;300,000*</td>
<td>P&amp;O Nedlloyd (now Maersk) partner ISO14001 and OHSAS 18001</td>
<td>Pier breaking</td>
</tr>
<tr>
<td>China</td>
<td>Jiangmen Zhongxin Shipbreaking Steel &amp; Iron company Ltd, Jiang Men City, Guangdong Province</td>
<td>300,000</td>
<td>ISO 14001 OHSAS 18001</td>
<td>Pier breaking</td>
</tr>
<tr>
<td>China</td>
<td>JiangMen Xinhui Shuangshui Shipbreaking &amp; Steel. Co. Ltd</td>
<td>60,000</td>
<td>ISO 14001 OHSAS 18001</td>
<td>Pier breaking</td>
</tr>
<tr>
<td>China</td>
<td>Xin Rong Recycling &amp; Logistics Co. Ltd (formerly Jiangsu Changrong Steel Co.)</td>
<td>&gt;100,000</td>
<td>ISO 14001 OHSAS 18001</td>
<td>Pier and dock breaking</td>
</tr>
<tr>
<td>China</td>
<td>Guangzhou Panyu Ship Breaking &amp; Steel Rolling Co**</td>
<td>40,000</td>
<td>ISO 14001 OHSAS 18001</td>
<td>Pier breaking</td>
</tr>
</tbody>
</table>

*According to the yard under expansion to 1,000,000 LDT/year

Indian facilities have gone through a certification exercise steered by the Gujarat Maritime Board resulting in the certification of 22 facilities according to press reports. A list of 32 facilities in Alang certified for ISO 18801 and OHSAS 18001 has been obtained from a cash buyer. Most yards were certi-

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53 List from GMS of certified ship yards in Alang in 2006
cation by International Certification Services (Asia) Pvt. Ltd., and some through the classification society RINA. Four yards Priya Blue Industries, R.K. Industries (unit 2), Bajnath Melaram Ship Breakers, and Shree Ram Vessel Scrap present the certifications on their company homepages on the internet.
Appendix D: Extended list of hazardous materials
The different types of hazardous waste to be identified at ships, classification of properties and their concentration limits.

<table>
<thead>
<tr>
<th>Substance</th>
<th>Classification of hazardous properties according to EU Hazardous Waste Classification</th>
<th>Description of concentration limits for hazardous waste</th>
<th>Basel Convention Hazard Class, Annex III</th>
<th>Basel Convention, Annex VIII</th>
</tr>
</thead>
<tbody>
<tr>
<td>Halons</td>
<td>Depends on the type of halons: Carbontetrachloride: T, Carc3 Methylchloride: Fx</td>
<td>Yes if conc. &gt; 3 %</td>
<td>H2</td>
<td></td>
</tr>
<tr>
<td>Propane (C₃H₆) Butane (C₄H₁₀)</td>
<td>Fx - flash point = -104°C Fx - flash point &lt; -20 °C</td>
<td>Yes</td>
<td>H2</td>
<td>A4080</td>
</tr>
<tr>
<td>Oxygen</td>
<td>O - (Oxidising)</td>
<td>No</td>
<td>H2</td>
<td>A4080</td>
</tr>
<tr>
<td>Acetylene (C₂H₂)</td>
<td>Fx - flash point = -18°C</td>
<td>Yes</td>
<td>H2</td>
<td>A4080</td>
</tr>
<tr>
<td>Carbon Dioxide (CO₂)</td>
<td>None</td>
<td>No</td>
<td>H2</td>
<td></td>
</tr>
<tr>
<td>Refrigerants such as R22/R12</td>
<td>Regulated according to Regulation 2037/2000</td>
<td></td>
<td>H2</td>
<td></td>
</tr>
<tr>
<td>Kerosene</td>
<td>Flash point = 50°C</td>
<td>Yes</td>
<td>H3</td>
<td>A3020, A4060</td>
</tr>
<tr>
<td>White spirit</td>
<td>Carc2 Flash point 13-61°C</td>
<td>Yes if conc. &gt; 0.1 %</td>
<td>H3</td>
<td>A3020, A4060</td>
</tr>
<tr>
<td>Alcohols</td>
<td>Flash point &lt; 23°C Flash point 23-61°C</td>
<td>Yes</td>
<td>H3</td>
<td></td>
</tr>
<tr>
<td>Methylated Spirits UN 1170</td>
<td>Flash point &lt; 23°C Flash point 23-36°C</td>
<td>Yes</td>
<td>H3</td>
<td></td>
</tr>
<tr>
<td>Fuel oil</td>
<td>Carc. 3</td>
<td>Yes of conc. &gt; 1 %</td>
<td>H3</td>
<td></td>
</tr>
<tr>
<td>Diesel Oil</td>
<td>Carc. 3</td>
<td>Yes of conc. &gt; 1 %</td>
<td>H3</td>
<td></td>
</tr>
<tr>
<td>Gas Oil</td>
<td>Carc. 3</td>
<td>Yes of conc. &gt; 1 %</td>
<td>H3</td>
<td></td>
</tr>
<tr>
<td>Biocides and phytopharmaceuticals including pesticides and herbicides</td>
<td>Toxic, but depends on the specific pesticide</td>
<td>Very toxic: 0.1 % Toxic (R23, R24 OR r25) : 3 % or Toxic R48 and R39) 1 %</td>
<td>H6.1</td>
<td>A4030</td>
</tr>
<tr>
<td>Substance</td>
<td>Classification of hazardous properties according to EU Hazardous Waste Classification</td>
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<tr>
<td>------------------------------------------------</td>
<td>---------------------------------------------------------------------------------------</td>
<td>------------------------------------------------------------------------------------------</td>
<td>----------------------------------------</td>
<td>-----------------------------------</td>
</tr>
<tr>
<td>Pharmaceutical products</td>
<td>Toxic, but depends on the specific pharmaceutical</td>
<td>Very toxic: 0.1 % Toxic (R23, R24 OR R25): 3 % or Toixc (R48 and R39) 1 %</td>
<td>H6.1</td>
<td>A4010</td>
</tr>
<tr>
<td>Radioactive materials</td>
<td>Radioactive</td>
<td>Dependent on the type of radioactive material</td>
<td>H7</td>
<td></td>
</tr>
<tr>
<td>Waste lead acid batteries</td>
<td>C (R35)</td>
<td>Yes if con. &gt; 1 %</td>
<td>H8</td>
<td>A1160</td>
</tr>
<tr>
<td>Asbestos</td>
<td>Carc1</td>
<td>Yes if con. &gt; 0.1 %</td>
<td>H11</td>
<td>A2050</td>
</tr>
<tr>
<td>Hexavalent chromium compounds</td>
<td>Dependent on the compound</td>
<td></td>
<td>H11</td>
<td>A1040</td>
</tr>
<tr>
<td>PCB and PCT containing substances</td>
<td>Dangerous to the environment</td>
<td>Yes, if con. &gt; 50 mg/kg</td>
<td>H11</td>
<td>A3180</td>
</tr>
<tr>
<td>Antimony</td>
<td>Dependent on the antimony compound</td>
<td></td>
<td>H11</td>
<td>A1010, A1020</td>
</tr>
<tr>
<td>Beryllium</td>
<td>Carc2</td>
<td>Yes if con. &gt; 0.1 %</td>
<td>H11</td>
<td>A1010</td>
</tr>
<tr>
<td>Cadmium, cadmium compounds</td>
<td>Dependent on the cadmium compounds, but mainly Carc2</td>
<td>Yes mainly if con. &gt;0.1 %</td>
<td>H11</td>
<td>A1010, A1020, A1080</td>
</tr>
<tr>
<td>Lead, lead compounds</td>
<td>Dependent on the lead compounds, but mainly Rep1</td>
<td>Yes, mainly if conc. &gt;0.5 %</td>
<td>H11</td>
<td>A1010, A1020, A1080, A1160, A2010</td>
</tr>
<tr>
<td>Zinc residues containing lead and cadmium in concentrations that render them hazardous</td>
<td>Depends on the zinc compound</td>
<td>Concentration limits varies widely</td>
<td>H11</td>
<td>A1020, A1080</td>
</tr>
<tr>
<td>Mercury, mercury compounds</td>
<td>Dependent on the mercury compound, but mainly T or Tx</td>
<td>T: if conc. &gt; 3% T: if conc. &gt; 0.1 %</td>
<td>H11, H12</td>
<td>A1010, A1030</td>
</tr>
<tr>
<td>Tin based anti-fouling coatings</td>
<td>Toxic and dangerous to the environment</td>
<td>T: if conc. &gt; 3%</td>
<td>H12</td>
<td>A4030</td>
</tr>
<tr>
<td>Lubricating oils</td>
<td>Dependent on the type of oil but mainly Carc 2</td>
<td>Yes if con. &gt;0.1 %</td>
<td>H12</td>
<td>A3020, A4060</td>
</tr>
<tr>
<td>Hydraulic Oils</td>
<td>Dependent on the type of oil but may be dangerous to the environment</td>
<td>No concentration limits</td>
<td>H12</td>
<td>A3020, A4060</td>
</tr>
<tr>
<td>Substance</td>
<td>Classification of hazardous properties according to EU Hazardous Waste Classification</td>
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<td>---------------------------------</td>
<td>--------------------------------------------------------------------------------------</td>
<td>--------------------------------------------------------</td>
<td>----------------------------------------</td>
<td>-------------------------------</td>
</tr>
<tr>
<td>Oil residues (sludge)</td>
<td>Dependent on the type of oil but may be dangerous to the environment</td>
<td>No concentration limits</td>
<td>H 12</td>
<td></td>
</tr>
<tr>
<td>Oil water mixtures</td>
<td>Dependent on the type of oil but may be dangerous to the environment</td>
<td>No concentration limits</td>
<td>H 12</td>
<td></td>
</tr>
<tr>
<td>Waste oils</td>
<td>Dependent on the type of oil but may be dangerous to the environment</td>
<td>No concentration limits</td>
<td>H 12</td>
<td></td>
</tr>
<tr>
<td>Oil contaminated rags</td>
<td>Dependent on the type of oil but may be dangerous to the environment</td>
<td>No concentration limits</td>
<td>H 12</td>
<td></td>
</tr>
<tr>
<td>Lubricating oils</td>
<td>Dependent on the type of oil but may be dangerous to the environment</td>
<td>No concentration limits</td>
<td>H 12</td>
<td></td>
</tr>
<tr>
<td>Hydraulic Oils</td>
<td>Dependent on the type of oil but may be dangerous to the environment</td>
<td>No concentration limits</td>
<td>H 12</td>
<td></td>
</tr>
<tr>
<td>Unsorted waste batteries</td>
<td>Dependent on the type of batteries</td>
<td></td>
<td>H12</td>
<td>A1170</td>
</tr>
<tr>
<td>Glass waste from cathode-ray tubes and other activated glasses</td>
<td>Regulated as WEEE (Waste of Electric and Electronic Equipment)</td>
<td>H13</td>
<td>A2010</td>
<td></td>
</tr>
<tr>
<td>Polyvinyl Chloride</td>
<td>None</td>
<td>Not hazardous waste</td>
<td>H13</td>
<td></td>
</tr>
<tr>
<td>Neoprene</td>
<td>None</td>
<td>Not hazardous waste</td>
<td>H13</td>
<td></td>
</tr>
<tr>
<td>Other Plastics</td>
<td>None</td>
<td>Not hazardous waste</td>
<td>H13</td>
<td></td>
</tr>
</tbody>
</table>