

## **Discussion document**

### Managing undesirable ship generated waste discharges in Marine Environments

Project nr. 250990  
revision 05  
November 2012

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Release date  
November 2012

revision 0.5  
Final report for Rijkswaterstaat Waterdienst

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November 2012

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## Management Summary

The marine environment, a vital resource for life on earth, includes oceans and seas covering 71% of the earth's surface that provide our greatest source of biodiversity. The marine environment is nowadays facing a number of challenges and threats caused by pressures from a range of sea-based activities including shipping and oil and gas exploration. In order to protect Europe's seas and oceans several efforts have been initiated with the aim to ensure long term productivity of economic and social activities (e.g., tourism, fisheries, industry) on the one hand, while addressing the challenges the marine environment is facing. In the light of these events the European Commission (EC) has adopted several Directives to protect Europe's marine environment more effectively and discourage waste disposal at sea. With this in mind the Marine Strategy Framework Directive (MSFD) was adopted in 2008. The Directive establishes a common framework with the ultimate objective to achieve good environmental status of the marine environment. Based on this Directive, Rijkswaterstaat, part of the Dutch Ministry of Infrastructure and the Environment, has carried out a study to assess the ecological status of its waters and the impact of human activities. This paper builds on the findings of this assessment by highlighting the possibilities for harmonisation of legislation on waste management in ports across Europe and provides insight in waste fee systems employed throughout these international ports. The objectives of this study are twofold: first, to lay a foundation for the European discussion on regulations and guidelines with respect to port reception facilities (for example in the upcoming review of the European Directive on port reception facilities). The second objective is to support policy makers participating in international discussion forums and events centred around topics such as the MSFD. An overview of the differences in legislation applied in various ports, together with a presentation of best practices, contributes to the discussions on this topic and may help to identify common solutions in international forums.

This paper presents the results of an inventory and study of waste collection practices of various international ports throughout Europe and is based on the following hypotheses:

1. The uniformity and transparency of laws and regulations on ship generated waste in all European countries with an international port might improve the disposal of waste to shore and discourage waste dumping at sea.
2. The harmonization of waste fee systems in European ports will simplify the waste disposal process and aid in the discouragement of dumping waste at sea.

The results presented within this document are based on interviews with different stakeholders within the European marine community and ports. During the visit of eight international ports across Europe, interviews have been carried out with representatives of the port and the reception facilities. An overview of selected ports and stakeholders is provided in Appendix 1 of this report.

The results of this study give a fair representation on how ship's waste is handled by ship captains and crew, port authorities, and waste collecting companies. A number of possible interaction points are addressed to identify possible intervention points and aid in the implementation of improved and more marine environment friendly operational practices.

### Conclusions

The outcome of the implementation of international shipping legislation is not the same in all EU - member states. This makes the various levels of legal hierarchy complex and difficult to understand by those who are required to adhere to this legislation. This study has pointed out that both Marpol convention as the European PRF Directive provide space for local interpretation. Although both have been implemented by all Member States, this is not done uniformly resulting in a high degree of diversity on the following eight points:

- The organisation of port reception and waste processing facilities;
- The definition of ships waste streams categories that can be delivered to a port reception facility and/or a waste processing facility;
- The volumes of the specific waste streams to be delivered according to the port waste fee system;
- Financial structure of the ports waste fee;

- The ratio between overall harbour costs and ships waste costs;
- The market waste collecting companies and waste processing companies operate in;
- The organisation and methodology of enforcement;
- The service level in waste collecting services;

This high degree of diversity provides incentives for non-compliant behaviour, such as littering. In most of the cases, non-compliant behaviour is caused by a low chance of detection and the high costs of delivery of waste to shore.

Shopping, another result of the lack of uniformity, does not lead to environmental problems provided that the waste is finally delivered on shore. The level of uniformity within the inland shipping can be used as a good example on how to revise the European PRF Directive and stimulate uniformity between ports across Europe.

It is also noteworthy that enforcement of the existing legislation is not carried out to its fullest potential. The division of the responsibility for enforcement of marine legislation between ports and national authorities gives rise to capacity problems and miscommunications, thus resulting in a reduced effectiveness and enforcement. In case an offence is identified, inspectors rarely fine the offenders due to the general formulation of regulations. It can be argued that unless the waste regulations are adjusted into more accurate obligations, the impact of enforcement will continue to be very limited. However, police and coastguard do respond immediately in case there is a clear relation between waste dumping and the offender (e.g. oil track, garbage containing ships name). In contrast to the on board checks such offences are often fined.

As waste costs are only a small fraction of total harbour costs for a ship, this could imply that the effect of harmonisation of these costs on behaviour of ships will be limited. On the other hand, harmonisation of the financing system of harbours can eliminate any financial incentive for unlawful behaviour and is therefore recommended.

Based on the interviews with the harbour representatives the following good practices have been identified:

- The 5 E's seem a very useful strategy to change behaviour;
- The marine awareness course;
- Track and information systems;
- Financial discounts;
- Insight in and knowledge exchange on how waste processing works.

A comparison of the above listed good practices implies that regardless of the selected waste management model the following aspects need to be considered:

- Fiscal incentive for good waste management;
- Discount on harbour fee for good waste management;
- Subsidies on board treatment;
- Reducing costs by improving recycling;
- Inform and educate;
- Innovate track and tracing systems.

The outcome of this study emphasizes that uniformity and transparency enable ship owners and ships crew to comply with the standards set by the shipping industry. The first hypothesis is therefore confirmed. The second hypothesis is confirmed partly. As harmonisation of waste fees bypasses regional differences in costs structure for waste processing. This can undermine an overall European system. Based on these observations it can be concluded that harmonization of waste fees does contribute to a higher volume of ships waste to shore, but is not a complete solution.

Considering the importance of a good environmental status of the marine environment for European member states in general and policy makers in particular the following recommendations are formulated on the basis of this study:

- Criteria for waste streams need to be harmonised at a European level.
- Efficiency and flexibility during waste handling needs to be improved and harmonised.
- Waste tracing systems must be employed in such way that they support responsible care of sustainable shipping companies.
- The financing systems should be harmonised, thereby selecting one system for Europe as a whole.
- New waste management systems should be explored.
- A maximum height of the waste fee in relation to the general harbour costs could be considered.
- The use of different forms of fines and rewards should be discussed and harmonised.
- The formulation of regulations should be accurate and specific in order to support enforcement. Law enforcement actors should be involved in the process law making to ensure that formulated legislation is specific and accurate.

## List of abbreviations

CDNI	<i>Convention relative à la collecte, au dépôt et à la réception de Déchets survenant en Navigation rhénane et Intérieure</i> The Convention on the collection, deposit and reception of waste produced during navigation on the Rhine and Inland Waterways
CO-WANDA	Convention for Waste management for inland Navigation on the Danube
CRP	Cost Recovery Principle
CSI	Clean Ship Index
EC	European Commission
ECSA	European Community Ship owners Association
EMSA	European Maritime Safety Agency
ESI	Environmental Shipping Index
ESPO	European Sea Ports Organisation
EU	European Union
FAT	Financing system Assessment Tool
GT	Gross tonnage
IIPC	International Organ for equalization and coordination
IMO	International Maritime Organisation
Marpol 73/78-	International Convention for the Prevention of Pollution From Ships
MSFD	Marine Strategy Framework Directive
NI	National Institute
NMa	<i>Nederlandse Mededingingsautoriteit</i> (Netherlands competition authority)
OECD	Organisation for Economic Co-operation and Development
Paris MoU	The Paris Memorandum of Understanding on Port State Control; European organisation for a system of harmonized inspection procedures designed to target sub-standards ships with the main objective being their eventual elimination
PPP	Polluter Pays Principle
PRF	Port Waste Reception Facilities
SOLAS	International Convention for the Safety Of Life At Sea
THETIS	Program to prioritise the European Port State Control inspection regime
VLAREA	Flemish regulations concerning waste prevention and management
WASCOL	Information system used by the Port authority of Antwerp to monitor ship generated waste within the harbour and corresponding documentation and fees paid
WFD	Water Framework Directive

## Table of contents

	Page
<b>Management Summary .....</b>	<b>3</b>
<b>List of abbreviations .....</b>	<b>6</b>
<b>1 Introduction.....</b>	<b>8</b>
1.1 Background and objectives .....	8
1.2 Hypotheses .....	8
1.3 Philosophy and implementation .....	8
1.4 Approach .....	9
1.5 Outline of this report .....	10
<b>2 Legislative framework .....</b>	<b>11</b>
2.1 General overview of international, European and national legislation.....	11
2.2 Short description of legislation mentioned .....	12
<b>3 Current practices.....</b>	<b>15</b>
3.1 Stakeholders .....	15
3.2 Application of laws and regulations .....	18
3.2.1 <i>Current practice on laws and regulations .....</i>	<i>18</i>
3.3 Finance and service .....	22
3.3.1 <i>Current practice of finance and service .....</i>	<i>22</i>
3.4 The market of port waste management.....	26
3.4.1 <i>Current practice of the market on waste management.....</i>	<i>26</i>
3.5 Enforcement and communication .....	28
3.5.1 <i>Current practice of enforcement and communication .....</i>	<i>28</i>
3.5.2 <i>Sanctions.....</i>	<i>29</i>
3.5.3 <i>Communication.....</i>	<i>30</i>
3.5.4 <i>Conclusion.....</i>	<i>31</i>
<b>4 Best practices and incentives provided by visited ports .....</b>	<b>32</b>
4.1 Framework for good behaviour (Norms and values) .....	32
4.2 Best practices.....	33
4.3 Conclusion .....	34
<b>5 Possibilities for new systems and economic incentives.....</b>	<b>36</b>
5.1 New waste management systems.....	36
5.2 New economic incentives .....	38
5.3 Other .....	39
5.4 Conclusions .....	40
<b>6 Conclusions, recommendations and discussion .....</b>	<b>41</b>
6.1 Conclusions .....	41
6.2 Reflection of results to the hypotheses.....	44
6.3 Recommendations and discussion .....	44
<b>Appendices .....</b>	<b>46</b>
<b>Appendix 1: Selected ports and stakeholders .....</b>	<b>46</b>
<b>Appendix 2: CDNI .....</b>	<b>47</b>
<b>Appendix 3: Overview of financing systems and harbours and markets visited .....</b>	<b>49</b>
<b>Appendix 4: Example of fees.....</b>	<b>51</b>

# 1 Introduction

The European commission has set the objective to improve the marine quality of the European sea. One of the environmental marine issues is littering. Waste originating from ships is, willingly or by accident, cast overboard. With the objective to ban littering, the European commission has introduced a range of legislation on maritime waste. The European nations have implemented this legislation in accordance with their national insights and traditions. As a result the rules and working methods differ within Europe. To improve the effectiveness of the laws and regulations on maritime waste harmonisation and uniformity need to be addressed. How and to what level is not yet clear.

## 1.1 Background and objectives

The objectives of this study are twofold: first, to support those Dutch government delegates participating in international discussion forums and events centred around topics such as the European Marine Strategy Framework Directive (MSFD), which are aimed at the protection of the marine environment. The second objective is to lay a foundation for the European discussion on regulations and guidelines with respect to port reception facilities (for example in the upcoming review of the European Directive on port reception facilities).

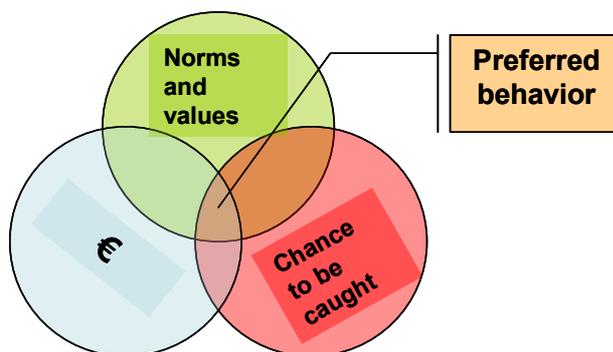
## 1.2 Hypotheses

This study is based upon two hypotheses. These hypotheses' are described as follows:

1. The uniformity and transparency of laws and regulations on ship generated waste in all European countries with an international port might improve the disposal of waste to shore and discourage waste dumping at sea.
2. The harmonization of waste fee systems in European ports will simplify the waste disposal process and aid in the discouragement of dumping waste at sea.

## 1.3 Philosophy and implementation

The above mentioned hypotheses in relation to the viable implementation of a workable solution should consider the influencing factors for those parties affected by this solution. Influencing behaviour in a regulated environment with a strong governmental vision on 'good practices', or 'preferred behaviour', is achieved through i) norms and values, ii) chance of detection (enforcement) and, iii) financial stimulation. This three pillar philosophy and the interaction between the different pillars is displayed in figure 1.



**Figure 1: Pillars of influence on behaviour**

Altering group behaviour is a difficult task to any government, especially if the required change has to take place voluntarily. All three pillars of influence need to be addressed to ensure that behavioural change is achieved. The reflection and discussion on the influence of behaviour will be addressed in accordance to the three pillar system, which is defined as follows:

#### Norms and values

Norms and values which are held as common practice account for behaviour within a population with any behaviour deviating from this standard being addressed by colleagues or other actors.

#### Financial stimulation

Financial stimulation accounts for behaviour within a population driven by economic incentives (financial benefits).

#### Chance to be caught (Enforcement)

The chance of detection accounts for behaviour within a population governed by third party enforcement and associated fines, punishments or sanctions.

## **1.4 Approach**

This paper presents the results of an inventory and study of waste collection practices in the following international ports throughout Europe (alphabetical order):

1. Amsterdam
2. Antwerp
3. Barcelona
4. Belfast
5. Hamburg
6. Piraeus
7. Rotterdam
8. Stockholm

Differences in regulations and practices enforced in European ports may result in uncertainty among ships crew on what to do, and as such reduce the effectiveness of waste reception facilities. This in turn could lead to an increase in the discharge of ship generated waste at sea. Given that reduction of waste disposal at sea is one of the objectives for the MSFD, a study of the differences in rules applied in various ports, including a presentation of best practices, contributes to the discussions on this topic and may help to identify common solutions in international forums. According to LEI (2011) and Sterk (2011) a common international approach with respect to the discharge of ship generated waste could be a cost-effective and efficient measure and provide a financial incentive to tackle the discharge of waste at sea.

The results presented in this document are based on a desk research consisting of an analysis of relevant rules and regulation at the national, European and international level, followed by a number of interviews with representatives from different stakeholders within the European marine community and ports. These interviewees represent a broad cross section of European ports based on geographical setting, size, type of ships using the port and type of cargo. An overview of selected ports and stakeholders is provided in Annex I of this report.

The results of this study describe how ships' waste is handled by ship captains and crew, port authorities and waste collection companies across Europe. It addresses a number of possible interaction points between these stakeholders and subsequently a number of possible intervention points to aid in the implementation of improved and more marine environment friendly operational practices. These interaction and intervention points are formulated as discussion points with the aim to improve the way ship waste is handled and hence reducing discharge at sea.

## 1.5 Outline of this report

This study aims to give an overview of the differences and similarities between the policies and instruments employed by European ports in order to identify good practices and key points for discussion.

Each chapter is completed with a reflection on the way waste streams are handled with respect to inland shipping. These reflections are presented in boxed text frames.

The differences and similarities will be addressed and analysed against the background of the rules and regulation at three levels: International, European, and national (government, harbour, ship). Chapter 2 provides an outline of all relevant rules, regulations and bylaws at these levels. In chapter 3 an overview is given of the current practices in the selected ports, followed by an analysis of best practices in chapter 4. New economic models and possible incentives are described in chapter 5. In the final chapter (chapter 6) the hypotheses are discussed including the implications of the identified best practices for policymaking at national and European level and concludes with a non limited list of possible key points for discussion.

## 2 Legislative framework

This chapter gives an overview of the legislation regarding ship generated waste that is relevant for European ports and the visiting ships. The results are presented in table 1. Starting from international, to European level and finally an overview of national rules and regulations. Paragraph 2 of this chapter gives a short description of the legislation mentioned in table 1.

### 2.1 General overview of international, European and national legislation

Waste legislation for ship generated waste is based on international conventions and European Directives. Within the European Union (EU) member states are obliged to transpose these Directives into national legislation. Every member state is free to choose how to implement these European Directives. As a result the various EU-states have widely contrasting implementation methods with some introducing completely new national laws while others stick to direct implementation (as displayed in table 1). This has resulted in waste legislation becoming a puzzle for shipping companies, captains and crew and undermines the objective of compliance at every port called upon. Most of the times shipping companies and/or captains will find an agent at the port of call to consult regarding the specific bylaws, costs, requirements and possibilities. With respect to waste disposal, this gives the agent a lot of influence on how legislation is interpreted and applied.

**Table 1: Overview of legislation on ship generated waste**

<b><i>International legislation (IMO)</i></b>
Marpol 73/78: International Convention for the Prevention of Pollution From Ships.
SOLAS: International Convention for the Safety Of Life At Sea.
<b><i>European legislation (EC)</i></b>
Marine framework Directive
Directive 2000/59/EC: Port reception facilities for Ship Generated Waste and Cargo Residues.
Directive 95/21/EC: Port state control
<b><i>Nationally implemented (State)</i></b>
National and regional environmental legislation
<b>Netherlands:</b> Prevention of Pollution by Shipping Act, Environmental Act, Water Act.
<b>Great Britain:</b> Health Safety and Environmental Policy Statement, Merchant Shipping and Fishing Vessels (Port waste reception facilities) Regulations 2003, Waste and Contaminated Land Order 1997 ('Duty of Care').
<b>Belgium:</b> Federal: Royal Decree of 20 July 1973 on the maritime inspection regulations, revised by Royal Decree of 1 September 2004 for the establishment of vessel inspections concerning the delivery of ship generated waste and cargo residues. Flemish: Decision by Flemish Government of 14 March 2003 establishing the Flemish regulations concerning waste prevention and management (VLAREA).
<b>Germany:</b> Convention on the Protection of the Marine Environment of the Baltic Sea 1992, Bundess Gesetz Bl. 2001 I S. 2276 ff & Hamburgisches Schiffsentsorgungsgesetz (HmbSchEG) & Schiffsabfallabgabenverordnung (Schiffs-AbgV) implementation of the Directive 2000/59/EC.
<b>Sweden:</b> Convention on the Protection of the Marine Environment of the Baltic Sea 1992.
<b>Spain:</b> National Law RDL 2/2011 implements EU Directive and Marpol and Local regulation, RD 1381/2002 implements EU Directive and Marpol in ports by laws.
<b>Greece:</b> Ministerial Decision 3418/07/2002 implements EU Directive.
<b><i>Locally implemented (Harbour, ship)</i></b>
Port management by-laws
Port Waste Management Plan
Self imposed rules and regulations (for example Clean Shipping Index (CSI)).
<b><i>Waste processing (Shore)</i></b>
Directive 75/442/EC, revised by Directive 91/156/EEG, 96/350/EC and 2008/98/EC.

## 2.2 Short description of legislation mentioned

### Marpol 73/78: International Convention for the Prevention of Pollution from Ships:

Marpol 73/78 is one of the most important international marine environmental conventions. It was designed to minimize pollution of the seas. Its stated objective is: to preserve the marine environment through the complete elimination of pollution by oil and other harmful substances and the minimization of accidental discharge of such substances. The original Marpol convention was signed on 17 February 1973, but did not come into force. The current convention is a combination of the 1973 Convention and the 1978 Protocol. It entered into force on October 2<sup>nd</sup>, 1983. As of 31 December 2005, 136 countries, representing 98% of the world's shipping tonnage, are parties to the convention. All ships flagged under countries that are signatories to Marpol are subject to its requirements, regardless of where they sail and member nations are responsible for vessels registered under their respective nationalities. The Marpol 73/78 convention identifies six groups of ship waste streams. For all six waste streams separate Annexes hold the different regulations that needs to be followed up on when handling the type of ship waste described. Of these Annexes this research mainly focuses on Annex I (Oily waste) and Annex V (Garbage), where Annex IV (Sewage) is of less importance.

All Annexes referred to in this report are the Annexes used in the Marpol convention. Any other Annex reference will be supplemented with the corresponding document name.

### SOLAS: International Convention for the Safety Of Life At Sea:

SOLAS is an international maritime safety treaty signed in 1974. The SOLAS Convention in its successive forms is generally regarded as the most important of all international treaties concerning the safety of merchant ships. The treaty requires flag states to ensure that their ships comply with minimum safety standards in construction, equipment and operation. It includes articles setting out general obligations, followed by an annex divided into twelve chapters. Of these, chapter five (often called 'SOLAS V') is the only one that applies to all vessels at sea, including private yachts and small craft on local trips as well as to commercial vessels on international passages. Many countries have turned these international requirements into national laws so that anybody at sea who is in breach of SOLAS V requirements may find themselves subject to legal proceedings.

### Marine Strategy Framework Directive:

The aim of the European Union's (EU) Marine Strategy Framework Directive (adopted in June 2008) is to protect the marine environment across Europe. It aims to achieve good environmental status of the EU's marine waters by 2020 and to protect the resource base upon which marine-related economic and social activities depend. The Marine Strategy Framework Directive constitutes the vital environmental component of the Union's maritime policy, designed to achieve the full economic potential of oceans and seas in harmony with the marine environment. The marine strategies to be developed by each Member State must contain a detailed assessment of the state of the environment, a definition of "good environmental status" at regional level and the establishment of clear environmental targets and monitoring programmes.

### Directive 2000/59/EC: Port reception facilities for Ship Generated Waste and Cargo Residues:

The Port Reception Facilities (PRF) Directive pursues the same goal as the 73/78 Marpol Convention on the prevention of pollution by ships, which all the EU Member States have signed. However, in contrast to the Convention, which regulates discharges by ships at sea, the Directive focuses on ship operations in ports within the EU. It addresses in detail the legal, financial and practical responsibilities of the different operators involved in delivery of ship-generated waste and cargo residues. Member States must ensure that port reception facilities are provided which, meet the needs of the ships using them without causing abnormal delays. These facilities must be tailored to the size of the port and to the categories of ships calling there. A waste reception and handling plan must be drawn up in each port. These plans must be approved and assessed by the Member State it relates to. The plans must be re-approved at least every three years. Captains of ships bound for a Community port are required to notify certain information, in particular the date and the last port in which ship-generated waste was delivered and the quantity of waste remaining on board. Unless exempted, all ships are required to deliver their ship-generated waste before leaving a Community port, unless the captain can prove that his vessel has adequate storage capacity. Ships that do not deliver their waste without providing valid reasons for exemption are not allowed to leave the port until such delivery has taken place.

Ports must establish cost recovery systems to encourage the delivery of waste on land and discourage dumping at sea. All ships calling at a Member State port will bear a significant part of the cost (which the Commission interprets as meaning at least 30%), whether they use the facilities or not. This cost recovery system comprises this built-in, fixed element and, possibly, a variable element according to the amount and type of waste actually delivered. Ships operating in an EU port may be inspected. There is a 25 % minimum inspection requirement. Inspections are as a priority carried out on ships which have not complied with the notification requirement and on those suspected of not having delivered their waste. Where it is proven that a ship has put to sea without having delivered its waste and without benefiting from an exemption, the next port of call is alerted. Moreover, the ship will not be authorised to leave the second port without the situation having been assessed.

#### Directive 95/21/EC: Port state control:

The purpose of this Directive is to improve maritime safety in Community waters by attempting to ban substandard shipping. It applies to all merchant ships using a seaport of a Member State or offshore terminal or anchored off such a port or installation. Member States are obliged to establish and maintain national maritime administrations ("competent authorities") for the inspection of ships in their ports or in the waters under their jurisdiction. The organisation for The Paris Memorandum of Understanding on Port State Control (Paris MoU) is responsible of maintaining overall standards and initiatives. The organisation for Paris MoU has the ability to prioritize inspections using the THETIS program. In this good behaviour will result in less inspections.

Each Member State is obliged to inspect at least 25 % of the ships flying other countries' flags which enter its ports. They are obliged to ensure that their competent authorities cooperate with their counterparts in other Member States. Each authority is obliged to publish, once every quarter, the details on the number of detentions ordered and what information needs to be provided.

#### Directive 75/442/EC, revised by Directive 91/156/EEG, 96/350/EC and 2008/98/EC:

Directive 75/442/EC and its revisions provide the necessary concepts of waste, waste categories and obligations attached to the different waste streams. The Directive also defines temporary storage and the legal regime applicable to those concepts.

#### National legislation

All legislation noted in table 1 is related to the national implementation of the European Directives and international conventions. Without this legislation it would not be possible for local authorities to enforce these conventions and Directives. It provides nations and harbour organisations the legal base to follow the European law.

### **Legislation for inland shipping**

The Convention on the collection, deposit and reception of waste produced during navigation on the Rhine and Inland Waterways (CDNI) is the counterpart of Marpol for inland shipping on the main rivers of Europe. This is the first waste treaty for inland shipping, in this particular case for the Rhine region. member states with other rivers, for example the Danube, are in close contact to put a similar treaty in practice. E.g., the "Convention for Waste management for inland Navigation on the Danube" (CO-WANDA) is currently in a conceptual phase and, at the time of writing, has yet to be formalized.

The goal of the CDNI is to:

- Encourage the prevention of waste generation;
- Canalize the disposal of ship waste to the dedicated waste reception facilities along the waterway;
- Ensure adequate funding in view of the "polluter-pays principle";
- Facilitate compliance with the prohibitions of discharge of waste into surface waters.

The regulation makes a distinction based on the origin of the waste on-board. It also takes into account the corresponding responsibilities of parties involved. A more detailed elaboration of the CDNI is given in Appendix 2 of this report.

### **Conclusion**

The Marpol convention and the European PRF Directive take precedence over all waste related regulations, forming the legal basis that shipping companies and ships have to comply with. Since EU-Member States have different international shipping legislations, the various levels of the legal hierarchy is complex and difficult to understand by those who are required to adhere to these laws and regulations.

Positive is the fact that every harbour visited has its own Port bylaws and Port waste management plan. After translation the bylaws and plans enable captain and crew tot deal with ships waste according the local regulations.

Compared to sea bound shipping laws, the treaty for inland shipping has a more open legislative structure, as most of the countries supporting this treaty have implemented the European text literally. The Netherlands are an exception to this rule having compiled a Dutch text, implementing it on two legal levels (through law and regulation). Exemptions asides, this unified approach results in a simplified system, easy to understand for everybody working within the value chain of inland shipping.

### 3 Current practices

In chapter two the law and regulations considering ships waste for sea going vessels are shown. This chapter gives a general description of the current system for handling ships waste (waste value chain) and any aspects that influence the way waste is deposited to shore. It addresses stakeholders, legislation, financial aspects, market overview and enforcement, as shown in figure 2.

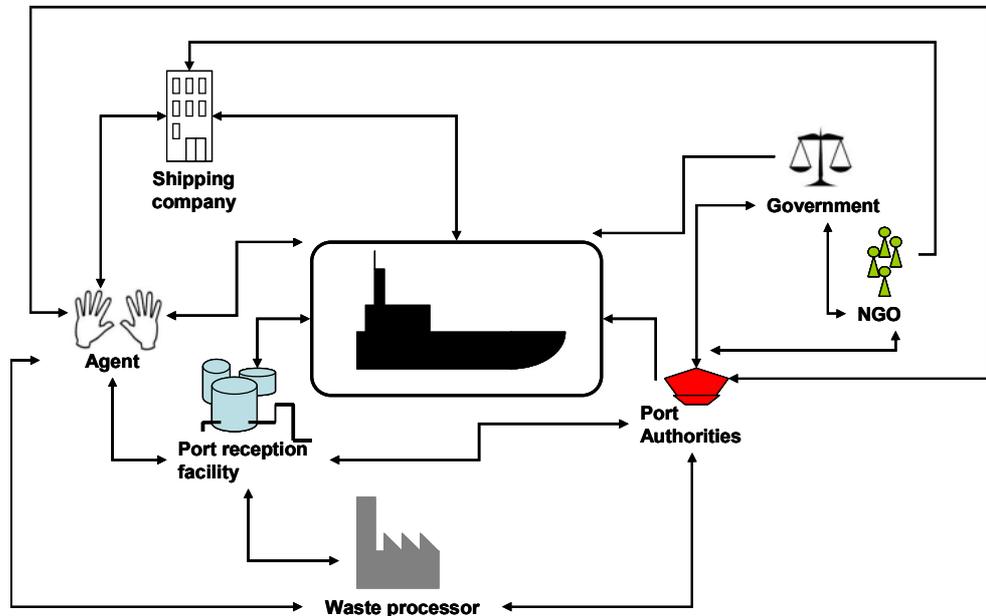


Figure 2: Ship waste handling system

These aspects are each related to the waste value chain of the ships waste. Based on this information the waste collection and possibilities for preventing dumping and littering are assessed further in chapter 4 and 5. Chapter 6 combines this information in a series of conclusions.

#### 3.1 Stakeholders

Within the process of waste disposal four main stakeholder groups are identified and described.

1. Firstly there is 'the ship' that needs to dispose its waste. The stakeholders associated directly with the ship are:
  - a. the ship's crew
  - b. the shipping companies who own and exploit the ship.
  - c. the agents that guide/advise the ships when visiting a harbour

For the first two parties the main concern is an effective and efficient load/unload-process within the harbour. Depending on the available time and available service level the process of waste disposal can have an influence on the logistic processes and the decision making of captains and shipping companies.

The shipping agent represents and acts on behalf of one or more shipping companies. They maintain a contractual relationship, in which the agent agrees to exercise services for the shipping company in exchange for a direct fee. In the case of a 'line agent' (the permanent representative of a regular scheduled service) the direct fee is usually a commission on the freight of the goods at the port of loading or unloading.

This means that the agents mediate between ship and harbour organisation and between ship and waste collector. From this perspective the agent has an considerable influence on the contracting of the waste collector (in case a choice exists).

2. Secondly, there are the stakeholders involved in the 'waste handling business':
  - a. port reception facilities, operated by waste collectors,
  - b. waste processors active within the harbours.

The port reception facilities are (mostly) private companies that make business out of collecting chemical (oily) and household waste. According to the PRF Directive international harbours are obliged to ensure that port reception facilities are present to collect residues, oily mixtures, and garbage generated from a sea going ship (see chapter 2 for more details on the PRF Directive). The service must be such that 1) the receiving operation can be performed as fast as possible to avoid delays in the loading and unloading process of a ship and 2) all waste streams and volumes can be disposed of if required. Some waste collectors also process the waste into (partly) merchantable substances. Others only collect the waste and pass it on to a third party waste processor.

3. Thirdly, there are stakeholders who have a formal/official role in the facilitation and financing of waste collection and treatment; in general related to the port authorities, other governmental organisations and departments involved.

First stakeholder to identify in this context is on European level; the EMSA.

The European Maritime Safety Agency is one of the Europeans' decentralised agencies. The Agency provides technical assistance and support to the European Commission and Member States in the development and implementation of European legislation on maritime safety, pollution by ships and maritime security. It has also been given operational tasks in the field of oil pollution response, vessel monitoring and in long range identification and tracking of vessels.

Per country and, sometimes, even per harbour the more formal/official stakeholders are different organized. On this level the following stakeholders are identified:

- a. The port authority is generally composed of the port authority itself (national)\_and a harbour organisation (local). The latter can be:
    - a private company (with government organisations as shareholder, e.g. Rotterdam)
    - a public organisation run by local government such as a municipality (e.g. Stockholm) or national government (e.g. Barcelona)
  - b. Within the port authority or government organisation the following departments can be identified:
    1. An organisation or department responsible for the facilitation of the waste collection and treatment. In general this department is also responsible if a tender is done to select waste collectors, and, when they are active, control their work.
    2. An organisation or department responsible to ensure the indirect financing system is functioning. This department is mainly responsible for the collection of the harbour fees and payment of the waste collectors providing services within the indirect finance system.
    3. An organisation or department responsible for the enforcement and inspections regarding waste related issues. This department is mainly responsible to check the compliancy of ships, the crew and the ships companies' activities with the relevant legislation.
4. Lastly, there are the third party stakeholders who are involved at a greater distance from the primary process. The following stakeholders have been selected based on their interest or influence on legislation. The selected stakeholders have been verified through an extensive desk research and interviews with harbour representatives.
    - a. Government organisations that have a formal role with regard to authorization and permits. For example ministries or competent authorities charged with the issuing of environmental permits allowing a company to transport, store and process waste.
    - b. Interest groups and branch associations that represent the interest of certain parties or a subject. Beside more broader environmental associations (for example Seas at Risk and Stichting Noordzee) the following branch associations play an important role with regard to waste handling in harbours:

- ESPO: The European Sea Ports Organisation represents the port authorities, port associations and port administrations of the seaports of the Member States of the European Union and Norway. The organisation promotes the common interests of its members throughout Europe and is also engaged in dialogue with European stakeholders in the port and maritime sector.
- ECSA: The European Community Ship Owners' Associations, comprises the national ship owner associations of the European Community and Norway. Its aim is to promote the interests of European shipping so that the industry can best serve European and international trade and commerce in a competitive free enterprise environment to the benefit of shippers and consumers.

### **Stakeholders' inland shipping**

The stakeholders involved in inland shipping and inland ship generated waste are mostly the same when it comes to collecting and processing waste. The four groups recognised within international shipping and ship waste are the same.

- Main difference is the stakeholder responsible for the financing of the costs involved in collecting and processing the ships waste. It is mandatory within the CDNI treaty for each country to appoint a National Institute (NI) responsible for the realization and maintenance of an uniform funding system for the collection and disposal of oily and greasy waste (addressed as category A-waste). Through this system the NI will pay the waste collectors. These NI's are monitored and checked by the International organ for equalization and coordination (IIPC) where all countries of the treaty are represented.
- Cargo residues (addressed as category B-waste) are handled differently from international shipping. Cargo residues are the sole responsibility of the cargo contractor and the cargo receiver. They are obliged to pay for all waste costs related to the cargo.
- Garbage and household waste (addressed as category C-waste) is not internationally organised. Ships are obligated to deliver waste to shore, but the infrastructure differs from one country to another and sometimes even within the countries themselves.

National authorities are responsible for the enforcement of all public parts, such as indirect finance, illegal discharging and incorrect cleaning methods (for cargo only). They are not involved in private agreements between ship and contractor.

### **Conclusion**

Stakeholders involved in waste handling from international ships are more or less the same in every country. The organisational structure and division of roles are generally the same in each harbour. However, the interests and influence of stakeholders differ per harbour. Besides the regulation in force which influences the position of stakeholders, the market (collecting and processing structure) plays an important role, see also paragraph 4.4. In an environment where legislation gives room for self interpretation or is complicated to understand (due to a number of different directives) agents are in a position to fill in the blanks creating a lucrative market for these parties. As a result there is a risk that the implementation of the legislation will be in the best interest of the agents and/or shipping companies and not in the best interest of the environment. In this case the tailored approach of the regulation for inland shipping could provide a more stable and uniform system.

### 3.2 Application of laws and regulations

This section gives an impression of the implementation of the legislation described in chapter 2. The information presented is based on interviews with port authorities and their impression of the knowledge and willingness of shipping companies and crew to comply with the laws and regulations on ship waste.

#### 3.2.1 Current practice on laws and regulations

The European ports confront visiting ships with a variety of national laws and regulations based on Marpol and the European Directive on port reception facilities. Most of these are implemented within the ports own bylaws. Different authorities carry out the enforcement of these regulations depending on the nature of the legislative mandate, both nationally and regionally. Port authorities operate as one of the parties entrusted to enforce the specific rules within the port's bylaws.

The specific local rules do not match with the international focus of the shipping companies. Their focus is not on specific national or local regulations. Therefore shipping companies know and uphold the international regulations such as Marpol and the PRF Directive and on occasion only check the port's bylaws. It is therefore important to know what level of understanding and knowledge shipping companies and ship crew (officers and crew) have of these rules and regulations. An understanding of rules and regulations is one of the most important incentives in the prevention of the dumping of ship generated waste. It is part of the methodology pillars of *Norms and Values* and *Chances of detection*. Figure 3 shows how rules and regulations are settled within the shipping companies/captains and their crew. In addition it gives insight in how the involved authorities perceive the implementation of the rules and regulations. This figure is a result of interviews held with representatives of the European Ports visited. It is therefore an impression of one of the (key) stakeholders involved (figure 2).

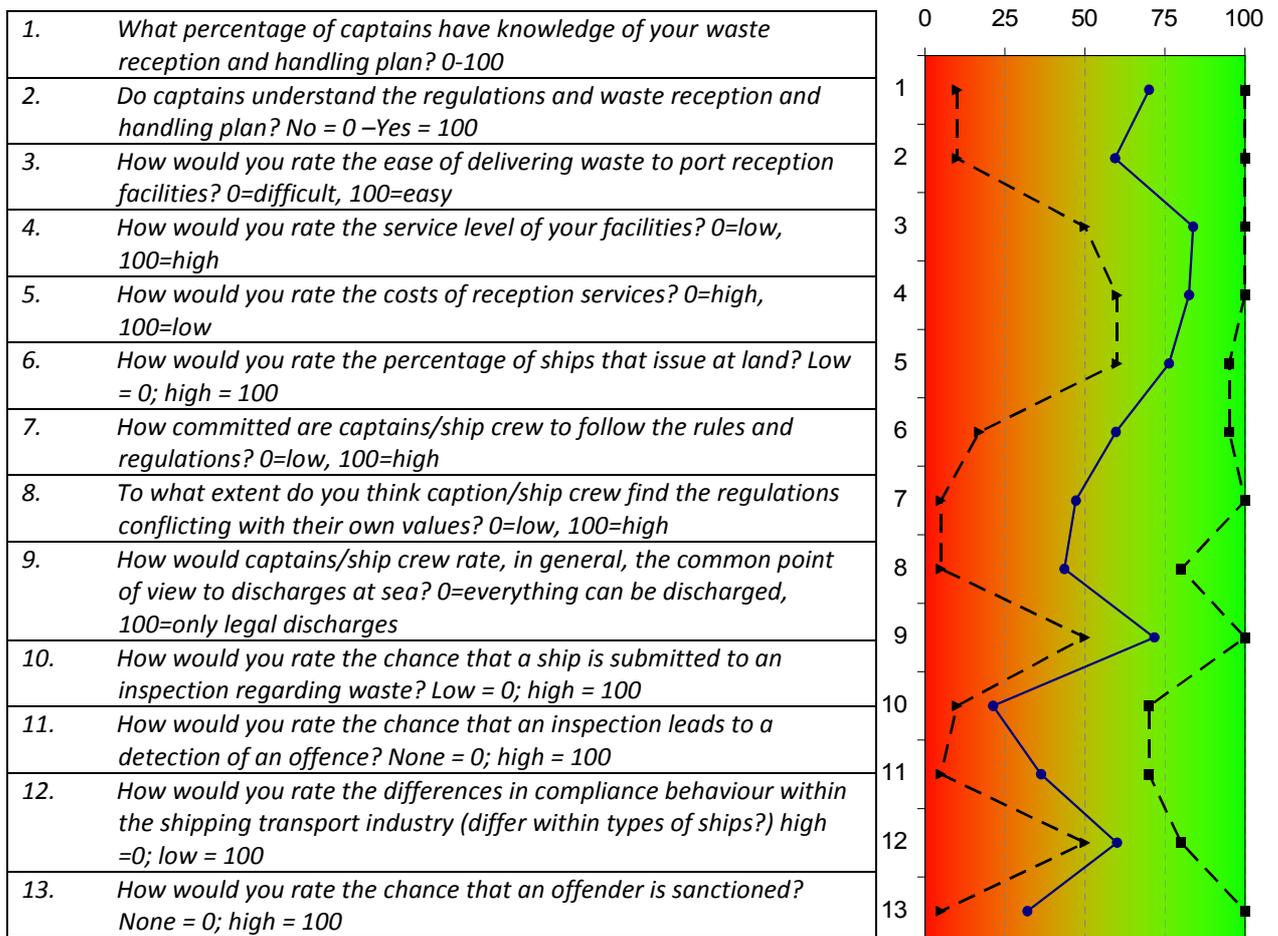


Figure 3: Level of understanding and upholding regulations by ship crew

Figure 3 shows three lines:

- The black middle line is the average score of all scores provided by eight different ports.
- The highest score given by all ports is shown on the right; green line with triangular points.
- The lowest score given by all ports is shown on the left; red line with square points.

This summary shows the range of the answers given and provides an impression of the diversity by which legislation is implemented and upheld within Europe.

The top questions (1 and 2) show that on average the rules and regulations are known while questions concerning the upholding of and compliance to the legislation by ships and their crews (questions 6, 7 and 8) score lowe.

The interviewees or not that positive on enforcement. The chance that ships sailing to port are submitted to an inspection are considered to be low. On top of that when enforcement is implemented it is difficult to prove if regulations are offended. For example whether the correct amounts of waste are properly disposed off and if the waste is segregated according to the rules (questions 10 to 13).

Notable is the close range of scores on the topic of ease to deliver waste, service level and how much waste is actually issued at land (questions 3, 4, 5 and 8). The reason for this is the availability of the information. This part of the process forms a daily part of the correspondents' work. Additionally, the questions addresses the harbours' primary responsibilities and could therefore result in a more socially desirable response.

The rules and regulations are all implemented within the port bylaws but, as shown in chapter 2, the result s of the varying implementation methods differ between the ports (e.g. differences in priorities set). Table 2 gives an overview of the variety of implementation methods of the international and European rules and regulations on ship waste.

**Table 2: Application of international and European rules and regulations on ships waste per harbour**

<i>Subject</i> <i>Harbour</i>	Way of documentation for reporting to port and deposited waste by collector/processor	Check waste volume reported and waste volume deposited	Direct and indirect fees for Annex I, V or both	Volumes depositing within the indirect fees limited or not.	Waste collection by tendering or free market	Incentive given to ships who deposit at shore	Enforcement on storage capacity related to follow up trip.
A	Digitally available and mandatory	Through automatised system	Both, focus on Annex I	No limit on deposit	Tendered	Yes both I and V. Focus on I	No
B	Digitally available and mandatory	Random check based on documentation of ship and waste collector	Both	Limited on both I and V	Partially tendered. Tendered on 5, open market on 1	Only overall to ship based on clean ship index <sup>1</sup>	Yes, based on average indexes. Applied by National authority
C	Digitally available and mandatory	Random check	Both, as well as for sewage and cargo residues	No limits	Tendered	For cruise on 5 when delivered in separated categories and on 1 when low % of water.	No; all waste is covered by indirect fee
D	Digitally available and mandatory	Check by waste collector	Both	Limited on both I and V	Tendered	None	Partially by water state police
E	Digitally available and mandatory	Random Check based on documentation of ship and waste collector	Both	Limited both on I and V	Partially tendered. Tendered on 5, open market on 1	Only overall to ship based on clean ship index	Yes, based on average indexes. Applied by National authority
F	Digitally available and mandatory	Check by waste collector, only large differences will be followed up on by port authority	Only for Annex V	No limit if there is a proper pré-register given.	Tendering for Annex V. Free market for Annex I, mostly shore orientated companies.	None	Yes by national authority
G	Digitally available and mandatory	Random check	Both	No limits	Tendered	Yes; Overall for ships with waste management plan	No; all waste is covered by indirect fee
H	Digitally available and mandatory	Through automatised system and frequent inspections	Both, as well as for sewage	Yes limited on both I and V	Tendered. Annex I is private contractor, Annex V is public-private association.	Yes; Time limits for handling time of waste collection and possible refund of 80% of paid fee upon disposal of waste streams.	Yes; by port state control

<sup>1</sup> CSI is an environmental certificate with a focus on energy and GHG emissions. Waste is not part of this certificate.

Table 2 shows a high level of uniformity on how Annex V waste is handled and the financing of this waste stream is organised. In contrast to Annex I waste, which is often privately collected, Annex V waste is considered to be more of a public issue to handle than private (even though the financing is still partly based on an indirect system). For both waste streams there is no uniformity in limitations to deposit volumes. They differ from no limits to a couple of m<sup>3</sup>.

Enforcement of ships waste legislation is primarily done by national agencies. Based on different forms of priority systems, on-board checks are performed, or a check of the documentation delivered is found sufficient. The same is found with respect to the incentives offered by the different harbours. There is no uniformity there. Some focus on service level (set a time window for the collecting company to perform its services) others offer a discount on either waste costs or total harbour costs.

### **Current practice of regulation for inland shipping**

Since the CDNI was implemented on 1st November 2009 not all countries have equally implemented all of the parts at the same time. Rules on oily and greasy waste came into force on January 1st, 2011, as not all participating states were ready with their financial structure required to put the indirect finance scheme into operation. This part has now been executed in all countries to an equal degree.

Cargo waste was implemented on the date that the CDNI came into force, but this part is often felt as the most complex as it is regulated in both public and private regulations (e.g. private transport contracts). The sector was and is still confronted with different stakeholders (dockworkers, storage and handling companies and companies working with large volumes of resources; customer) involved in ordering the cargo transport. Both types of companies are reluctant to uphold the rules and regulations and often these parties are located in different countries making it difficult for shipping companies to (en)force compliance.

In case of household and hazardous waste part C has still not yet been implemented equally in all countries. On January 1st, 2012, the discharge prohibition for vessels able to accommodate 50 or more passengers (cruise ships) was implemented in all participating European states. Other Part C waste should be implemented in accordance with the objectives of the convention by 1st November 2014.

### **Conclusion**

As noted in chapter 2 the implementation of international legislation on waste into national legislation has resulted in differences between the member states. This chapter shows that this has affected how these regulations are applied and upheld. The organisation of waste handling and collection differs widely between the harbours visited. Problems occur when those required to uphold the law (e.g. ship's crew) do not fully understand all of the relevant legislation. Simplicity at all levels of legislation is imperative.

When the chances of 'being caught' are low and fines are low there is minimum stimulation to alter non-compliant behaviour (Table of Eleven<sup>2</sup>).

This may all be an impetus for ships to go shopping for harbours with the lowest legal risk combined with the best cost balance.

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<sup>2</sup> The 'Table of Eleven' is a model based on behavioural sciences, consisting of eleven dimensions. Together, these dimensions are decisive for the level of compliance with legislation. The eleven dimensions are formulated with a view to as high a practicability as possible in the fields of policy-making and law enforcement. The dimensions provide criteria with which we can assess whether or not it is possible to enforce draft legislation. These criteria, however, can also be used to evaluate existing legislation.

### 3.3 Finance and service

This section presents a general picture of the financing system that is in place to manage ship generated waste in the selected harbours. In section 4 an assessment of the financing system is carried out on the basis of this information.

#### 3.3.1 *Current practice of finance and service*

For each harbour the current practice is described for each of the following elements:

- *Indirect financing*: system where ships that enter a harbour pay a fee to the harbour authority. A part of this fee covers the costs for waste disposal at a port reception facility. Fees are usually based on the type and volume of the ship expressed in Gross Tonnage (GT);
- *Direct financing*: system where ships pay directly to waste collecting companies for the waste they discharge on shore. Fees are usually based on volume or weight of waste streams. Direct financing is in most cases used to cover the costs for waste that is not covered by the indirect financing system;
- *Other*: the relative significance of waste costs for shipping companies and the financial result of waste management for port authorities were also inventoried.

The financing systems can differ per waste category. This research focuses on:

- *Annex I*: regulations for the prevention of pollution by Oil and petroleum-driven wastes (Bilge, Sludge, Slop, Waste oil, Polluted cargo etc.);
- *Annex V*: regulations for the prevention of pollution by garbage and trash.<sup>3</sup>

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<sup>3</sup> Marpol treaties 1973/1978.

**Table 3: Current practice of financing systems of the harbours studied.**

Financing issues	Findings
<b>1. Indirect financing</b>	
Percentage of costs covered	Seven out of eight harbours have some form of indirect financing. In only one harbour there is no direct financing. It is not possible to calculate which percentage of the total costs for waste is covered with indirect financing.
Waste streams covered	
annex I	In six out of eight harbours indirect financing contributes to covering the costs for Annex I. In two harbours these costs are covered by direct financing.
annex V	In <i>all</i> harbours indirect financing is used to cover the costs of annex V, although not every harbour's definition of Annex V streams that resolve under this financing structure is the same (e.g. dunnage is not always included).
Basis	Six out of eight harbours base the indirect financing on GT, one on engine power and for one harbour the national law and taxes have precedence.
Limits quantity	
annex I	The use of an indirect financing system does not imply that ships can infinitely discharge of their waste. In seven out of eight harbours there is a maximum / limit to the discharge of waste. These limits vary strongly and are often stated in m <sup>3</sup> , money and/or related to storage capacity. One harbour has no limits. Two harbours have theoretic limits which are not upheld.
annex V	Also for annex V in all but one harbour maximum limits for the discharge of waste are defined. There are 3 harbours that have such high maxima that in practice ships do not pay extra for annex V.
<b>2. Direct financing</b>	
Tariffs	Private contracts are made between agents and shipping companies. The tariffs that waste collecting companies use are not accessible for this study.
<b>3. Other</b>	
Significance of costs	Most harbours explicitly state that for the shipping companies costs for discharging marine waste are small compared to other harbour costs. Some harbours stated this is 5%, others speak of 'a small percentage'. In some cases, especially for small ships, waste costs are significant.
Financial results on waste	Five out of eight harbours claim a negative financial result on waste management. They put in more money than they collect with indirect financing. Three harbours break even. Financial losses vary from 0,2 mln. to 4 mln. euro a year. For harbours a financial loss can be acceptable as proper waste contributes to environmental goals. A loss can be acceptable if this is compensated with a profit in other years and thus an overall break even.

Now that a more transparent picture of the financing system of waste management in harbours is presented, it is possible to assess the financing system. The Financing System Assessment tool was used to score the financing system in harbours.<sup>4</sup> This assessment holds five criteria:

- Sufficiency: deals with the question to what extent is the funding sufficient to meet targets and cover costs for both investments and maintenance;

<sup>4</sup> Outline of The Financing system Assessment Tool (FAT), Water Governance Centre and Sterk Consulting, 2012.

- **Stability:** deals with the question to what extent is the funding stable. The stability has to do with the long term financial and political stability;<sup>5</sup>
- **Cost Recovery Principle:** deals with the question to what extent do users pay for services;<sup>6</sup>
- **Effectiveness:** deals with the question to what extent is the financing system effective;
- **Efficiency:** deals with the question to what extent is the financing system efficient.<sup>7</sup>

The results for the waste financing systems are:

- **Sufficiency:** in most cases the financing system does not generate sufficient revenues for the harbour. Harbours seem willing to pay for environmental goals or for a better image. Also they may want to compensate these losses in later years. It is quite possible that the waste collectors do make a profit. This part of the market however is not transparent;
- **Stability:** the financing systems are not very stable. Even though waste costs are limited in comparison with total harbour costs ships do seem to shop for the best deal which undermines stability. Also harbours regularly make changes in the financing system (especially between direct and indirect financing) making the system more unpredictable and thus less stable;
- **Cost Recovery Principle (CRP)/Polluter Pays Principle (PPP):** there is no causal relation between fees paid and waste issued, especially when the indirect financing system is dominant.
- **Effectiveness:** results of waste collection are improving. This might be explained by the financing system in place. Due to a lack of sufficient data, no causal relation can be assumed between waste collection and the financing system in place.
- **Efficiency:** for ships, waste costs are a relatively small part of the total harbour costs. As a result of this ships do not want to put too much effort in their waste management. However in the current practice the complexity of the financing systems is striking. The systems are perceived as non-transparent (tariffs of waste collectors are not accessible), complex and bureaucratic. Within the systems there is differentiation between direct and indirect financing, tariffs, volumes and administrative procedures (deposit systems). All this results in an inefficient system where ships put too much time and effort in the disposal of waste. At the same time an incentive is created for ships to go shopping with their waste.

To illustrate some of these points the following example gives an idea on how the fees differ from one port to the other, and the difficulties encountered when calculating these costs.

#### **Illustrative example: Large differences in waste fees for a ship between ports.**

It is not possible to give an overall comparison for waste costs between harbours. Systems are too complex and different and total costs are also depending on the possibility of refunds, the volume deposited related to the paid fees and direct paid charges to waste collectors on extra deliverance of waste streams. Therefore an overall exemplary calculation has been made for a common situation encountered within all visited ports, based on the information noted in the different port waste management plans on their fee system.

The waste fees have been calculated for a ship with a registered capacity of 10,000 GT and an engine power of 9,000 kW. It is a bulk carrier and holds 2 m<sup>3</sup> of miscellaneous waste and 5 m<sup>3</sup> of bilge and oily waste.

For this type of ship waste fees were calculated for 8 harbours (an overview is given in Appendix 4 of this report). The total costs, in Euros, vary from:

- Minimum: € 50,-
- Maximum: € 1.056,-
- Average costs: € 424,-

<sup>5</sup> The criteria sufficiency and stability are introduced in: OECD studies on Water, Water Governance in OECD Countries: A Multi-level approach, 2011, p 109.

<sup>6</sup> Water Governance 3, 2011 p 44 - 45 , Herman Havekes.

<sup>7</sup> Several economic studies: Financing water resources management, Water pricing 21st century, Experiment with new practical applications of economical instruments, Service desk Water.

This example clearly demonstrates the significant differences in waste fees between different harbours. These differences may drive ships to 'shop' in order to reduce their waste fees. However waste fees are only a (small) part of the ships total harbour fees. Besides costs also other aspects such as possible delay and the required effort to deliver waste may be an incentive to 'shop'.

### **Finance for waste generated from inland shipping**

There are different systems in function for financing the inland waste collection. The funding for deposit facilities is provided on the basis of the "polluter-pays" principle.

- This is implemented by an overall system of indirect finance through bunkered gasoline for oil and greasy waste (part A). As of January 1st, 2011 every ship pays a disposal indirect fee of €7.50 per 1000 litres of (tax-free) gas oil bunkered. The indirect fee is evaluated each year to ensure that all costs of handling oil and greasy wastes are accounted for.
- For garbage and other 'household' waste costs are calculated according to the region where waste streams are deposited. This will usually be done at a private site or through private companies and direct payment is needed. There is no harmonization of fees yet as the collection varies between countries.
- There is no indirect financing system for the cargo-generated waste. In principle the contractor of cargo or the cargo receiver (depending on whether it is dry or liquid bulk) is responsible for the costs of cleaning the ship and the cargo residues.

### **Conclusions**

The main conclusions on the financing system for port waste management are:

- In most harbours a hybrid system of indirect and direct financing is in place. In one harbour waste management is entirely financed with indirect financing.
- The financing systems are fragile in term of stability, sufficiency, Cost Recovery Principle and efficiency. The financing system does seem to be effective as waste collection has increased and professionalised over the last years.
- The weak elements of the financing system lead to:
  - Harbours continuously reconsidering and comparing their financing system with one another;
  - Ships shopping (to some extent) with waste e.g.:
    - Ships favour Rotterdam and Amsterdam for garbage(annex V) because of tariff and high limits;
    - Oil (annex I) goes to Antwerp because of good service and high limits;
    - Cruise ships favour Barcelona for Annex V;
    - Cruise ships favour Stockholm for sewage;
    - Harbours focus on ships typical for the respective region;
  - Waste collectors that have unknown revenues on marine waste;
  - Agents that bridge the gap between supply and demand.

### 3.4 The market of port waste management

In this section a general picture is given of the current market for ship generated waste in harbours.

#### 3.4.1 *Current practice of the market on waste management*

In order to assess how the market works a general description of the main stakeholders is given

- a. demand side: shipping companies and harbour authority demanding waste management services.
- b. supply side: waste collecting & processing companies supplying waste management services.
- c. agents that operate between these stakeholders and bring together demand and supply.

In the stakeholder overview of figure 3 the government is stated as a fourth party but in the market they are not a stakeholder due to the fact that they are not a commercially operated organisation.

##### *Ad 1: Demand:*

On the demand side two parties are active: the shipping companies and the harbour authorities that demand waste management services. .

Shipping companies are allowed to discharge waste by paying both the harbour authority (indirect financing) and the waste collection companies (direct finance). Shipping companies face regulation that prescribes what to do with their waste. In practice it is the shipping companies, not the individual ships, that arrange for the discharge of waste. Ships have no other role then a logistic role. They deliver the waste, but do not make the contractual arrangements with agents and waste collecting companies. The shipping companies consider the costs of waste to be small compared to other harbour costs. However they do shop (to some extent) with waste. Apparently costs and service levels are an incentive that influence the behaviour of shipping companies.

The harbour authority collects the indirect financing fee from ships and uses this to pay part of the costs of the waste collecting companies. The harbour authority wants to manage waste in a durable and legal way. They are the competent authority in a position to determine which market players are allowed access to the marine waste collection market. They have to work within the boundaries of national and international regulation. Under the current system they are claiming financial losses on waste and are reconsidering their systems.

##### *Ad 2: Supply:*

On the supply side the waste collection companies are the key players that supply waste management services. Agents bridge the (knowledge) gap between supply and demand. The waste collection companies collect and process the marine waste. They are partially paid by the harbour (indirect financing) and partially by the shipping companies (direct financing). On the supply side an assessment was carried out to examine to what extent the market is regulated through tendering, to what extent companies collect waste without the support of indirect financing (unbound companies) and what the role of the agents is for each harbour. Table 4 presents the results of this assessment of the current practice of financing systems for the harbours included in this study.

**Table 4: Current practice of the supply side of the market.**

Market supply side	Findings
Extent of market-regulation	<ul style="list-style-type: none"> <li>• In six harbours market regulation is partially in place. Annex I is in most cases a more open market (more participating companies, less tendering) than annex V (less participating companies, more tendering).</li> <li>• In two harbours the market of waste collection is fully regulated by tendering the waste collecting companies for both annex I and V.</li> <li>• In all harbours the tariffs that the waste collecting companies charge to the shipping companies are not accessible (private contracts)</li> </ul>
Unbound companies	<p>Unbound companies are not common:</p> <ul style="list-style-type: none"> <li>• For annex I there are 2 harbours that allow unbound companies;</li> <li>• For annex V only one harbour allows unbound companies.</li> </ul>
Role agents	<p>In five harbours the role of agents is large and dominant. This is especially the case in harbours that have a hybrid financing system. The role of agents is less dominant in fully indirect financed harbour and/or the more regulated harbour.</p>

Noteworthy findings are:

- Shipping companies seem to shop (to some extent) with waste. Apparently waste costs are an incentive even though they are relatively small compared to harbour costs and even though waste management is strongly regulated.
- Harbour authorities have partially regulated the waste collecting companies in their harbour (annex V is more regulated than annex I).
- This economic regulation should provoke competition. However questions remain on the functioning of the supply side of the market:
  - tariffs and costs of waste collecting companies are unknown / not accessible;
  - profitability of waste collecting companies (for marine waste) is unknown. Profitability can depend on the quality of the waste management chain of that company;
  - profitability can also depend on the degree of competition. Recently three Dutch collectors of marine waste were fined by the Dutch competition authority (NMA). They were fined 3 mln. Euro for agreements on pricing and cartel behaviour<sup>8</sup>. This means that authorities have now taken serious steps to enhance competition on the supply side;
  - the number of unbound companies is limited but may indicate high profitability of waste collection companies;
  - there may be cross-subsidizing within waste collecting companies (using indirect financing for other purposes such as agents or other waste streams);
  - some question the tariffs that are currently used for annex I, as the value of these waste streams (e.g. oil) may be significant.

### **Market of waste generated from inland shipping**

In four of the European member states the collection of part A is tendered. Companies who are rewarded this tender can acquire the income through the indirect fee paid by the National Institute. One member state has not tendered, as it is too small and therefore the collection is done in a near state. One member state is currently setting out a tender. There are no free riders as they will not be paid from the indirect fee and know the ship will pay directly as they have already paid through their bunkering.

Part B is in principle a free market, as no indirect fee is applied.

For Part C is a mix of market forms applicable, depending on the waste stream and country. For household waste is there an indirect fee via the harbours, or other systems, and is therefore tendered.

### **Conclusions<sup>9</sup>**

The waste collection and processing market is by no means a perfect market. This is not surprising as this is an environmental market with strict legal boundaries. Waste disposal is not a service one wishes to purchase but instead one which is imposed on an operator. Differences in tariffs between countries have to do with differences in the costs of processing waste, in other words the efficiency of the waste management chain (e.g. the residual value of waste differs largely). Differences in tariffs may also have to do with a lack of competition on the supply side. The presence of agents is a characteristic indicator of an imperfect market and is in place in many harbours. Recently harbours try to enhance competition through tendering of contracts. Also the possible lack of competition on the supply side is more actively monitored (and fines are given if required) by Competition Authorities (such as the Dutch Competition Authority)

## **3.5 Enforcement and communication**

### **3.5.1 Current practice of enforcement and communication**

Inspections are often carried out within the framework of the Port state control. The arrangements for Port State Control are made under the Paris Memorandum of Understanding on Port State Control. This is the official document in which the twenty seven participating Maritime authorities agree to implement a harmonised system of Port State Control. It consists of a main body and annexes that describe:

1. The commitments of the different Maritime authorities and relevant international conventions,
2. The inspection procedures and procedures to investigate operational procedures of ships,
3. The commitment and method of the exchange information,
4. The structure of the organisation and amendment procedures.

The inspection protocols are based on environment (MARPOL) and safety (SOLAS). The organisation for The Paris Memorandum of Understanding on Port State Control (Paris MoU) is situated in The Hague and its website contains substantial information concerning the inspection of ships. This organisation uses a naming and shaming system for flag states that are known for poor environmental or safety awareness. In the annual report of the Paris MoU, countries are divided in to a so-called White, Grey and Black list (White: 'Ships operate according to international regulations' to Black: 'Ships are a danger to crew and environment').

The organisation for Paris MoU has the ability to prioritize inspections using the THETIS program. Good behaviour will result in less inspections. If a ship is inspected two or more times and in all cases all appears to be in order, the ship will be back on the 'white list'. This method is in line with the incentives to comply as mentioned in the Table of Eleven and as visualised in the three pillar approach of this study.

<sup>9</sup> In response to this report the Organisation of environmental service companies to the shipping industry Netherlands (VOMS) noted that they did not recognize the conclusions given in §3.4. In their response they stated that the market does have a strong competitive nature and a lack of international focus in a strong international operated market.

In principle, the inspections are carried out by the national authorities and occasionally by the port authorities. The inspections consist of both an administrative and a physical control. The inspection themes for waste include a logbook check; checks on garbage on board and a check of the storage capacity.

Authorities find it often difficult to perform inspections on waste related regulation, especially garbage, as it is not known what the volume of garbage is that a ship will generate per trip. There are checkpoints for oily discharge like the overboard pipe where possible oil discharges can be detected. If this pipe contains residues of oil there is a possibility that oil has been discharged at sea. In that case the police can investigate further. In cases regarding miscellaneous waste some Port State Control organisations use a more communicative strategy followed by encouragement to issue at land. When, for example, is noted that a lot of garbage is on board the ship, strict enforcement is difficult (and therefore time consuming) as a legal basis is missing. The used communication strategy is usually followed up with the same result as strict enforcement. This comes with the benefit of keeping a positive relationship between ship (shipping company) and harbour and fits perfectly within the methodology of the Table of eleven and the three pillar approach of this study.

Some organisations use a matrix to determine the amount of capacity storage needed for the coming trip. This matrix makes it also possible to calculate the amount of waste needed to be discharged to shore at the moment of inspection. Input for this matrix is the ships planned journey to the next port of call (shorter or longer trips). The remaining storage capacity (after discharge) must be sufficient to store all waste produced while sailing to the port of call (next point of discharge). The inspection is often on sight; it's either half full, quarter full or has to be issued.

The following observations at the ports visited were also made:

- The minimum number of ship inspections as prescribed by the European Commission is 25% of all ships calling into port. National authorities reduce the minimum number of inspections through the use of THESIS.
- Those ports without their own inspectorate are usually unaware of previous inspectors findings.
- In the prioritization based on Port State Control (waste and safety), no "green label" vessel is taken into account, as a number of cases have shown that these vessels are frequently in a state of non-compliance with national or port regulations.
- Ports are rarely checked on their obligation to have a Waste Plan or on whether an existing plan has been fully implemented. In most of the cases governments do not have any true sanctioning capabilities. A port can be held accountable by the resident country's national authority. This signal of non-compliance is then issued to the European Commission responsible.

### **3.5.2 Sanctions**

Any evidence of illegal discharges is usually circumstantial. Subsequently any enforcement and the appropriation of sanctions remains a difficult process.

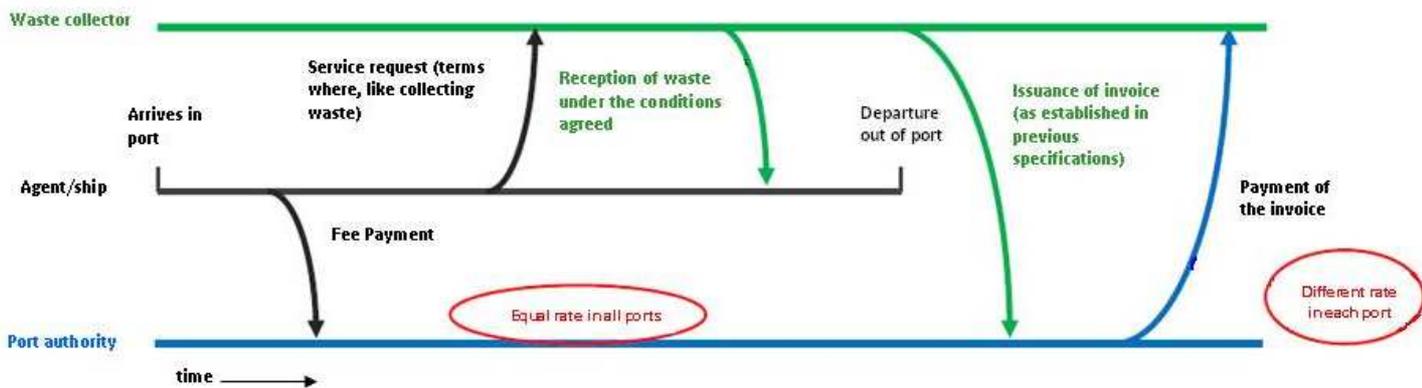
For Annex I it is easier to determine if any illegal discharge has taken place as this is visually more easy to spot due to the physical properties (lighter than water) and due to the design of the installations where oil is used. Illegal discharge is often related to the oil / water separator and its operating circumstances. If it is not working properly or inadequately maintained then quite often it is fair to say that oil has been discharged.

With the exception of Annex I, no sanctions in terms of fines are issued. This is also influenced by the fact that current legislation has limited possibilities to implement strict enforcement (e.g. prescribed waste bins, maximum volumes). Instead a ship is forced (see paragraph 3.5.2 communication) to issue to land which in turn will cause delay and therefore cost money. When the ship leaves the port before complying, the next port of call will be informed and the ship still is forced to issue its waste at this next port of call. Contrary to the on board checks, offences are fined in case of a clear relation between waste dumping and the offender (e.g. oil track, garbage containing ships name). Police and coastguard do respond immediately. In the Dutch waters this occurs ten to fifteen times a year.

### 3.5.3 Communication

All of the visited harbours in this project have a waste handling and reception plan. This plan can be interpreted as a policy on waste and is therefore often used internally or in relation to the government. In some cases the plan is written in the country's native language and therefore less suitable for communication with external parties (e.g. crew of international ships), thus leaving room for agents to mediate between harbours and ships.

Matters of interest to the agents and shipping companies are the ways in which ports have implemented the indirect funding and the services provided in return. The harbours communicate often through their website what the base rates are for the port dues and what the direct and indirect fees are for waste. Most of the agents handling the ships are well versed with the system available in the port of call and which port facility is available.



**Figure 4: Points of contact between Port, Agent/Ship and Waste collector.**

Figure 4 describes the points of contact between the port, collector, agent and ship in the port of Barcelona and is exemplary for all ports visited. The communication between ship and harbour is mainly to report the amount of waste they would like to issue (pre-arrival notification). The agent of the ship will contact the collector and ask for a facility. Once the waste is collected the collector will notify the harbour with the quantity collected and charge the harbour for the service. The harbour will approve the bill and credit the collector accordingly.

If the port facility does not service a ship to its satisfaction the ship can contact the harbour authority. This is done through the ports system for complaints.

The notification system for ships addressing a complaint to the Port Facility is often troublesome. The notification is initially made to the port authority and thus the problem is often explained, amicably settled and/or omitted. If no solution is found, an official complaint can be made through the IMO procedure. The European commission receives a copy. This procedure is often very difficult to follow and no feedback is given as to the result of the complaint, so it is often dropped by the complainant.

#### **Enforcement en communication for inland shipping**

Enforcement of the CDNI differs per country. The National institutes, even when they are not appointed as an inspection unit, can declare whether the indirect fees are paid or not. The electronic payment system, which all National Institutes have access to, can notify when a payment is not done. Inspections on discharging at rivers and on the cleaning process are carried out through physical inspections on board. These inspections are performed according to an obligatory document which states the method applied on waste discharge (discharge declaration).

### 3.5.4 Conclusion

Direct contacts between port authorities and ships crew regarding waste is rare. The moments of contact between these two are:

- Through direct communication (pre-arrival notifications)
- Through indirect communication (e.g. agents, collectors)
- Through complaint forms
- Through enforcement

The direct contact between inspection authorities and ship's crew is often formal. Starting point is the pre-arrival report in where reports of waste volumes are obligatory according to the European Directive. This document is used for the overall check on the volumes expected to be delivered to shore. Communication goes through documents, even the complaint procedure is a digital document often to complex for captains to fill in and therefore unlikely to be utilized.

Personal contact is only found during inspections. Here the focus is on whether or not a ship is in compliance. Enforcement of the discharge obligations is difficult due to the fact that there are no uniform methods and policy rules used by the inspection authorities. These methods and rules could help inspection authorities in the member states to decide whether or not a ship as to deliver or whether it has enough storage capacity on board (e.g. prescribed waste bins, prefix waste volumes per sailed miles).

This is probably the reason why it is not considered as a possibility for fruitful communication or as an educational instrument. This contrary to the learning's of the Table of eleven, which states that communication is the first step to compliancy.

Inspection authorities have difficulties to comply to the percentage set for ships inspections in the PRF directive due to lack of capacity. A priority system should prevent that ships with big environmental and safety risks are missed. This system is now in place through THETIS.

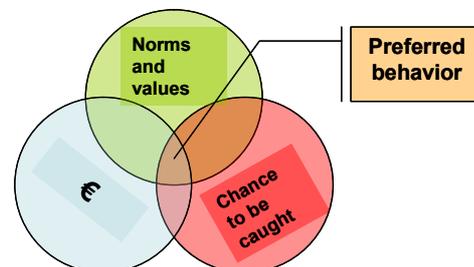
.Enforcement is usually seen as a 'last resort' instrument by port authorities according to ESPO's green guide and the representatives interviewed.

Both within direct and indirect moments of communication, and in the case of enforcement, opportunities are missed to increase awareness and open discussions.

The communication and enforcement of the inland ships have a similar structure with the exception that the National institute has more direct contact with the ship-owners, due to the recognition of the National institute and the crucial role it plays within the value chain of inland ship's waste and cost recovery.

## 4 Best practices and incentives provided by visited ports

This section provides an insight into best practices and incentives mentioned by the representatives of the harbours visited. Given that some of the best practices mentioned during these interviews are also described in the ESPO's 'Green Guide'<sup>10</sup> (October 1<sup>st</sup> 2012), the objective of this chapter is twofold: firstly, to provide an insight into the principles and best practices mentioned in the Green Guide. Secondly, to reflect on the best practices mentioned during the interviews.



All best practices and incentives described below are linked to one, two or all of the pillars of influence shown in the figure on the right.

### 4.1 Framework for good behaviour (Norms and values)

ESPO's Green Guide introduces a common framework for action under 5 E's:

**Exemplify, Enable, Encourage, Engage and Enforce.**

1. **Exemplify:** Setting a good example towards the wider port community by demonstrating excellence in managing the environmental performance of their own operations, equipment and assets.
2. **Enable:** Providing the operational and infrastructural conditions within the port area that facilitate port users and enhance improved environmental performance within the port area.
3. **Encourage:** Providing incentives to port users that encourage a change of behaviour and induce them to continuously improve their environmental performance.
4. **Engage:** With port users and/or competent authorities in sharing knowledge, means and skills towards joint projects targeting environmental improvement in the port area and the logistic chain.
5. **Enforce:** Making use of mechanisms that enforce good environmental practice by port users where applicable and ensuring compliance.

In the Green Guide it is also stated that "It should be noticed that the enforcing element is seen by port authorities as a last resort instrument." (ESPO, 2012:7). This is in line with their belief that a lot can be achieved through cooperation and common understanding through the principle of self-regulation. However, the latter is in contrast with statements of representatives from visited ports. At two of the visited ports strict enforcement in combination with a strong fining system was considered as the basis for improved waste control. In the remaining ports visited the ESPO-vision of cooperation and a common understanding is employed with great enthusiasm. At these ports it was clear that employees of the harbour and waste collectors were using the 'Engage'-E to stimulate change in behaviour of harbour-users (captains and crew).

<sup>10</sup> ESPO, (2012) 'Green Guide: Towards excellence in port environmental management and sustainability' ESPO: Brussels. Available at:  
[http://www.espo.be/index.php?option=com\\_content&view=article&id=92&Itemid=85](http://www.espo.be/index.php?option=com_content&view=article&id=92&Itemid=85)

## 4.2 Best practices

### **Marine Awareness Course (Norms and values)**

The port of Rotterdam is very proud of its 'Marine awareness course' concerning ship generated waste and its effect on the environment. This course is aimed at captains and crew as well as agents and shipping companies. In order to set the right example they send their own captains and crew to this course so they can educate the ship's crew when boarding. Part of the course includes a moment to think about new possibilities to increase the share of waste sent to the waste handling companies on shore. One of the ideas is to prescribe standard containers for waste storage. This will improve handling time and reduce the space taken by waste on-board of the ships. This is an idea to consider in the upcoming review of the PRF Directive.

### **Track and information system (Chance to be caught, €)**

In Antwerp, WASCOL has been implemented for several years. WASCOL is an information system used to monitor ship generated waste within the harbour. When entering the harbour a ship/agent reports the amount and sort of waste that is on board and what amount is to be collected. Subsequent to collection, the waste collector reports the collected waste and in combination with the report of the ship/agent any discrepancies are noted and any corrective action required of the ship/agent is then communicated. In combination with the incentive-based indirect fee system, Antwerp's method can be considered as a best practice. Given that Antwerp is often asked to present its system, this strengthens the idea that the employed system is considered to be a best practice.

The harbour of Piraeus has a similar system with an even broader perspective as National laws oblige the Port of Piraeus to prove that the waste generated through harbour activities (collection and production) is properly processed. The Piraeus system has a monitoring and tracking system with a complete overview of the waste value chain. It makes it possible for the Port of Piraeus to automatically produce the needed reports for the National authorities, input for enforcement, checks on ship's obligations to issue at land, paid fees, etcetera. The two systems provide good examples of how a universal European system could operate and support national governments and harbours in their effort to increase the amount of waste issued at land.

### **Financial stimulation when sustainable (Norms and Values, €)**

In some harbours ships are granted a discount on the harbour fees when they take environmentally friendly actions. For example when separating waste on board or when they participate in a sustainability program such as the Environmental Shipping Index (ESI). The ESI identifies seagoing ships that perform better in reducing air emissions than required by the current emission standards of the International Maritime Organization. The website of ESI presents a list of participating harbours visited in this project. Amsterdam, Rotterdam, Antwerp and Hamburg give some kind of financial incentive (e.g. a discount on the harbour fee) that is linked to the score of a ship on the ESI<sup>11</sup>.

### **Environmental Forum (Norms and Values, €)**

In Belfast stakeholders from in and around the harbour participate in workshops in which ideas are discussed, aimed at improving efficiency and effectiveness in the broadest sense. With the Environmental Forum, Belfast Harbour incorporates a "best practice" club & resource efficiency workshop.

Additionally, the recycling of waste is an important topic and new initiatives are formed within the workshop to increase the percentage of waste recycled. This has resulted in a rise from 78% to 84% since 2011. Furthermore it is clear that if the proper conditions were created 99% of waste would be recyclable. In a two year period an impressive 10,7 million pounds ( 13,3 million Euros) of potential cost savings have been identified, 210 potential synergies declared and 107,082 tonnes of waste has been diverted from landfill by recycling<sup>12</sup>.

### **Transformation from 5 waste streams (Marpol Annexes) to 70 residues (Norms and Values, €)**

<sup>11</sup> List of incentive providers ESI: <http://esi.wpci.nl/Public/PortIPs#>

<sup>12</sup> Source: Report of Synergy workshop Belfast Harbour Commissioners

The Port of Barcelona considers the harbour as a place where 'two waste management systems have to become compatible', referring to the step from 'ship waste' to 'waste to be processed'. In order to create insight in the waste handling process and the scrap value of waste, 70 residues (e.g. water, paper, glass et cetera) are recognized within the 5 Marpol Annexes.

#### **100% inspections on system level (Chance to be caught)**

In Hamburg every ship entering the harbour is inspected by police. Inspections are conducted on a general level and cover multiple aspects. Waste handling is one of these aspects. Should the police find something in conflict with the rules, the harbour authority is called in for further inspection. With this method every ship captain/agent knows that an inspection will be conducted and compliance with the rules is encouraged.

#### **Time saving by setting a window frame (Norms and Values)**

In Piraeus, additional terms for the waste handling company state that the collection of ship's waste has to take place within a time frame of three hours. Given that the waste disposal process is often a time consuming process in many harbours, the three-hour time frame forms an incentive for ships to dispose their waste.

#### **Reflection on the CDNI for best practices to apply within international shipping**

- The National Institute is responsible for the realization and maintenance of an uniform funding system for the collection and disposal of oily and greasy ship waste. The National Institute also manages the participating parties such as waste collection facilities and their payment through indirect finance. Each quarter the National Institute reports the income from the indirect finance system and the costs for the collection and processing of Part A waste to the International organ for equalization and coordination. This provides a system of finance where all costs and income are shared through an equalisation formula.
- The legislation of inland shipping has a strong focus on all parties involved within the value chain of ships waste. It provides a matrix of organised legislation for the type of waste on the one hand (A, B or C see section 3.2) and the key players involved on the other hand. Hence, every company and governmental organisation involved knows what to do and where their responsibility starts and ends. Legislation with a clear link to common practises makes it easier to understand, accept and uphold.

### **4.3 Conclusion**

The best practices differ between the nations. This is reflected in the interviews with the harbour representatives showing that the local conditions largely determine the direction to change behaviour of the involved people. A typical example is , the choice between enforcement and communication. The port of Stockholm has great faith in communication and model behaviour in order to change behaviour whereas the belief in enforcement as a tool for behavioural change is very low. The ports of Hamburg and Amsterdam share an opposite view on this issue .

The best practices illustrated in this chapter give the following insights:

1. The 5 E's (Exemplify, Enable, Encourage, Engage and Enforce) seem a very useful strategy to change behaviour. In addition to the philosophy stated in paragraph 1.3, it is essential to make sure that all 5 E's are given attention to and kept in balance with each other.
2. The Marine Awareness Course is an accessible and fun way to educate ship crew. Beside that, it is an practice that is relatively easy to implement.
3. Track and information systems will become more relevant as techniques are developing and the amount of traffic is growing. The systems from Antwerp and Pireaus both are good examples that other harbours can learn from. To what extent these systems are easily replicable and connectable to existing systems is not yet clear.

4. A discount is an stimulation that will encourage people to comply to regulation and behave as desired. When discounts are related to environmentally friendly actions the environment can be the winner. Financial incentives are effective as long as the incentive is attractive enough (in financial compensation and ease of use).
5. The Belfast Environmental Forum and the insight in the waste process that is presented in Barcelona are powerful developments that give companies and people a practical insight in how waste processing works and more important, how waste can be prevented by smart combinations of processes and products.

## 5 Possibilities for new systems and economic incentives

In this chapter new initiatives are described which could contribute to the improvement of the functioning of waste management systems in harbours. A distinction is made between completely new waste management systems (paragraph 5.1.) and the introduction of economic incentives within the current waste management system (paragraph 5.2). Other possible incentives are discussed in paragraph 5.3. The conclusions of this comparative analysis are presented in paragraph 5.4.

### 5.1 New waste management systems

In this section, two alternative models for waste management in harbours are described: a collective/public model and a private model. For each model a brief description of the essence of the model is given including the financing system, the stakeholders and the process of implementation.

#### 1. Collective indirect financing model: waste management system with 100% indirect financing

- *Essence of the model:* this model includes a publicly managed system of a group of harbours where costs are financed through a standard fee (close to 100% indirect financing). In this system limits for waste discharge are set in such a way that only in exceptional cases (<5%) ships have to pay extra for the waste that exceeds these limits. Competition is provoked on the supply side (waste collecting & processing companies supplying waste management services) by professional tendering and benchmarking. This model is comparable with both the model used for Part A of the inland shipping and with the collection of household waste on land.
- *Financing system:* in this model the financing is collective and indirect. All ships pay a indirect fee, depending on their size (GT), which covers the costs for the discharge of waste. In this system there is no financial incentive for any ship to shop or illegally discharge waste.
- *Stakeholders*
  - Shipping companies: the indirect fee may rise, but there will be no more time consuming procedures and hardly any direct payments when waste is discharged.
  - Harbour authority: the harbour authority in this model regulates the market. It has to provoke serious competition among the waste collectors by careful tendering of activities and monitoring of the service level.
  - Waste collecting companies: can enter this market after taking part in a tendering process. Serious attention for organising competition on the supply side is a must as agreements on pricing and cartel behaviour have been detected (Netherlands). Prices of waste collecting companies may fall as competition is provoked in a more professional way.
  - Agents: role of agents will diminish as there is no more shopping for deals and tariffs.
- *Implementation:* in this system it may be wise to start with just one waste stream to keep things simple. Annex V would be the most designated waste stream as it does not represent any value nor is it the major cause of concern for the MSFD. Another possibility would be to implement this model in a number of the more progressive harbours. Implementing this system would take a minimum of 2 – 4 years as running contracts in current systems will need to be transformed.

#### 2. Private market dominated waste management system

- *Essence of the model:* fully free market based system where all, or a group of, harbours accept this system and costs for collecting waste are directly paid by ships to waste collecting companies. The ships pay a variable price for weight or volume when waste is discharged.
- *Financing system:* in this model the financing is direct and fully variable. All ships pay only for what they discharge. In this system there is a financial incentive for ships to shop or illegally discharge waste.
- *Stakeholders:*
  - Shipping companies: may be able to shop for the best deal and reduce costs of waste. They will have to self-enforce the environmental regulation.

- Harbour authority: the harbour authority will have to set boundary conditions for the market and put all of its efforts into enforcement.
- Waste collecting companies: can act the same as in a free market and contact and contract shipping companies. maximum competition is provoked.
- State governments (Europe): will have to put all effort in to developing a tracking system and very strict enforcement of regulations.
- Agents: may still have a role in this model. However it is expected that their role will be minimized.
- *Implementation*: implementing this model seems easy but will in fact mean that much of the current regulated market will have to be reorganised. It will take a minimum of two years to transfer the market.

### Assessment of the two models

Both the 'collective indirect financing model' and the 'private market dominated model' are assessed with the *Financing system Assessment Tool (FAT)*. The results are:

- **Sufficiency**: deals with the question to what extent is the funding sufficient to meet targets and cover costs for both investments and maintenance;
  - Collective indirect financing model: if revenues and costs are closely monitored and evaluated on a yearly basis, it is feasible for harbours to collect sufficient means to cover all costs on the long term. For inland shipping this system has proven to cover all costs. In case of poor planning there is some risk of insufficient means;
  - Private market dominated model: in this model sufficiency is not an issue for the harbours as the market regulates itself and harbours are not responsible for sufficient means.
- **Stability**: deals with the question to what extent is the funding stable. The stability has to do with the long term financial and political stability;
  - Collective indirect financing model: this type of system has proven to be (politically) stable on the long term (inland shipping). Naturally service level and functioning have to be evaluated on a yearly basis to keep the system up to date and stable;
  - Private market dominated model: this waste management system is also reasonably stable. It relies on the market principles of supply and demand. There is some risk for the harbour that supply fails in delivering the required capacity or quality. This may occur if ships move to other harbours because of better prices or services. Especially in countries where a poor waste processing system leads to high prices, this risk may occur. This system may be quickly questioned in case of environmental incidents. Incident can result in political pressure to put environmental issues in public hands.
- **Cost Recovery Principle**: deals with the question to what extent do users pay for services;
  - Collective indirect financing model: in this model there is no full relation between the waste that ships discharge and the price that is paid. In practice however there will be a reasonable interpretation of this principle as the fee is based on variable criteria such as the size of a ship
  - Private market dominated model: in this model there is a 100%, fully variable, relation between pollution and payment.
- **Effectiveness**: deals with the question to what extent is the financing system effective;
  - Collective indirect financing model: in this model there is *no* financial incentive to discharge waste incorrectly. This is very effective for a durable discharge of waste;
  - Private market dominated model: in this model there is a financial incentive to discharge waste in an unsustainable way. There is a risk of illegal discharge of waste since enforcement is difficult
- **Efficiency**: deals with the question to what extent is the financing system efficient.
  - Collective indirect financing model: this model is relatively efficient. Because of it's simplicity, transaction costs are expected to be relatively low. However as it is a highly regulated system, there is a risk of less competition and possibly less innovation;
  - Private market dominated model: in this model there is more competition leading to a continuous incentive for of innovation and improvement.

In table 5 the scores of the two waste management systems are summarised. Comparison to the existing systems within Europe is not possible because of the differences within the European ports (as displayed in Appendix 3 of this report). Based on this summary the Collective model would be preferred over the Private model. This excludes the (political) weight that can be given to the criteria set. If this is taken into account it is not (yet) possible to decide on either model, since both have positive and negative aspects. A European discussion on the weighing of the criteria will be necessary to come to a final decision.

**Table 5: Scoring the two models\***

Criteria / Models	1. Collective indirect financing model	2. Private market dominated model
Sufficiency	±	+
Stability	+	±
CRP/PPP	+	++
Effectiveness	++	-/-
Efficiency	±	+

\*= scored from +/+ (strong) to -/- (weak)

## 5.2 New economic incentives

This section describes a number of possible economic incentives that might contribute to a decrease of the risk of illegal waste discharges. These are not new 'all in' models as described in the previous section, but instrument / incentives that can fit in both the current and new models.

### 1. Fiscal incentive for good waste management

- *Essence:* national governments could consider a temporarily fiscal advantage for clean ships. As with clean cars, a temporary fiscal measure (such as discount on taxes) could contribute to a shift towards a more durable waste management system. Possibly, this concept could be linked to the Clean Shipping Index (CSI) or other labels such as the green award. CSI now focuses on air emissions, but fitting in the issue of waste could be considered. Governments could then pass on a fiscal advantage for ships that hold a certificate.
- *Financing system:* this would be a publicly financed incentive. The government could stimulate either ownership (fiscal advantage when purchasing a ship) or exploitation (fiscal advantage on exploitation such as fuel costs or VAT) of ships with this certificate.
- *Theoretical assessment:* this principle has worked very well in the car industry. It has proven to be effective, but burdens the public resources. However if it is implemented for a limited period (e.g. 5 years) costs are manageable and a true shift in waste management is feasible.
- *Support stakeholders:* the harbours interviewed are not too enthusiastic when it comes to labelling unless it has a clear relationship to its goal, being more waste streams coming to shore with a higher market value. A significant fiscal incentive however could be effective as shipping companies are sensitive to financial incentives. For shipping companies this seems an attractive option. Port authorities are interested when this can be achieved by a minimum amount of documentation and organisational capacity while maintaining a high level of service to ships who call to port.

## 2. Discount on harbour fee for good waste management

- *Essence:* harbour authorities could consider a discount on the direct or indirect harbour fee for clean ships. This is already in place in Stockholm and Rotterdam for ships with the CSI. Fitting in the issue of waste could be considered.
- *Financing system:* a budget neutral financing system based on a bonus / malus principle is an option. This means that the relative contribution of 'dirty' (non-labelled ships) is higher than the contribution of the ships holding the certificate. Contributions should be evaluated on a yearly basis to avoid deficits (possible when all ships get labelled). Another option is that harbour authorities pay for the discount of clean ships. In this case it is a bonus system and not a bonus/malus system.
- *Theoretical assessment:* this principle may work well. The effectiveness will depend on the relative difference between the different categories of ships.
- *Support harbours:* the harbours may be reluctant for this system as the 'dirty' ships will be more critical towards that harbour. For shipping companies this seems an attractive option (free choice, no negative effects)

## 3. Subsidies on board treatment

- *Essence:* an economic incentive for a more technical approach could be to actively stimulate the development of technology that will help ships to treat waste on board. Techniques for on-board treatment of sewage are available and waste to energy technologies are being developed. In many cruise ships waste treatment for sewage is already in place. This helps preventing incorrect behaviour. Subsidizing efforts in this direction may lead to technical innovations and better behaviour.
- *Financing system:* There are several ways to stimulate research. A project could be subsidized through a public contribution, but also funding initiated by harbours could be an option. As with the fiscal options this incentive should be limited in terms of time and money.
- *Theoretical assessment:* investing in innovation is a high risk / high yield activity. Innovation may lead to a significant breakthrough, however there are no guarantees.
- *Support harbours:* most of the harbours are supportive to all on-board technologies that help reduce the environmental impact of ships' activities where there are no new infrastructural works necessary at port quays, e.g. wall current is still not common on quays while most ships have the infrastructure installed on-board.

## 4. Reducing costs by improving recycling

- *Essence:* when ships are charged for waste streams the tariffs should take into account the residual value as a secondary material. Therefore waste should be separated accordingly. The streams that have no/less value will reduce and so will the costs.
- *Financing system:* this system could finance itself. The indirect fee could be used only for waste with no/less value. Waste with value can then be discharged free of charge.
- *Theoretical assessment:* An incentive like this could well be part of the public model as described in the first section.
- *Support Harbours:* harbours should facilitate in the separated collection of such streams.

## 5.3 Other

Other possible incentives have to do with education and innovation

### 1. Inform and educate

- *Essence:* educate crew and officers on the effects of littering and dumping to the marine environment.
- *Incentive:* they now know the effect of their actions and can no longer hide behind ignorance.
- *Theoretical assessment:* Rotterdam has an educational course and Stockholm is continuously educating through their port employees. It is noted that this gives a behavioural change in ships crews and officers.
- *Support harbours:* good practice will be followed.

## 2. Innovate track and tracing systems

- *Essence*: combine the European ships register (Safeseanet) with waste management information based upon, for example, the Belgian / Greek system.
- *Incentive*: The system facilitates the information streams 1) Captains only need to provide their navigational information once 2) All data is available for European ports to follow and check up on ships.
- *Theoretical assessment*: Investing in an already existing system with an additional module - waste. Paid for by a central part of the waste fees of European ports and based on the port of Antwerp's evolved system of waste management.
- *Support Harbours*: most harbours will support this as long as they can fit their working procedures within this system. Most of them remain slightly reluctant due to the fact that they think that the ships coming to their port are special and they need a special system. Probably most obstruction will come from national governments.

Table 6 presents an overview of all the incentives that were described in this chapter.

**Table 6: Overview of new waste management systems, economic and other incentives**

Waste management systems for harbours	New economic incentives	Other incentives
1. Collective indirect financing model	1. Fiscal incentive for good waste management	1. Inform and educate
2. Private market dominated model	2. Discount on harbour fee for good waste management	2. Innovate track and tracing systems
	3. Subsidies on board treatment	
	4. Reducing costs by improving recycling	

## 5.4 Conclusions

It is possible to develop new waste management models for harbours that provide a better perspective for good competition (and thus less costs), less shopping with waste and, most importantly, less differences in costs for ships. One of the new models can fully eliminate any financial incentive for ships to discharge waste at sea. If one European model is used, all harbours must conform to this model. It will take a big effort for probably a long period of time to overcome thresholds and political resistance. However, based on the criteria set in paragraph 5.2 an open European discussion is the first stage. This discussion could be the starting point for this new uniform system.

Besides fully new waste management models, it is also possible to achieve results by implementing economic incentives. Although harbours are reluctant when it comes to new economic incentives, several economic incentives are thinkable which may contribute to the better functioning of marine waste management and thus, possibly, reduce littering at sea.

Fiscal incentives that reward good behaviour and subsidies for developing on-board treatment are strong examples of economic incentives to optimise waste management. Education to raise awareness and innovative track and tracing systems are other incentives that may also contribute to less littering.

## 6 Conclusions, recommendations and discussion

The Marpol convention and the European PRF Directive take precedence over all waste related regulations, forming the legal basis that shipping companies and ships must comply with. Both Marpol convention as European PRF directive give room for local interpretation. As a result the EU-Member States do not all implement international shipping legislation in the same way. This makes the various levels of the legal hierarchy complex and difficult to understand by those who are required to adhere to these laws and regulations. A typical example is that the the Marpol convention and the PRF Directive oblige a waste fee system based upon the polluter pays principle, but the form and the percentage are only given as a guideline.

Positive is the fact that every harbour visited has its own Port bylaws and Port waste management plan making it more easy for captain and crew to know how ships waste has to be dealt with locally. Side note to this is the fact that some of these bylaws are only available in the native language and/or are hard to find on the ports website and not always in hardcopy available.

Compared to sea bound shipping laws, the treaty for inland shipping has a more open legislative structure. Most of the countries supporting this treaty have implemented the European text literally, with one exception the Netherlands

### 6.1 Conclusions

#### **Differences in implementation by member states and harbours contribute to non-compliant behaviour.**

As stated in the introduction of this paragraph the Marpol convention and PRF Directive of the European Community take precedence over all ships waste related regulations, forming the legal basis which shipping companies and ships have to comply with. European member states have taken the possibility for local interpretation. Therefore international (shipping) legislation is not implemented uniformly. This has resulted in a high degree of diversity on the following eight points:

1. *The organisation of port reception and waste processing facilities*; there are ports with just one facility open to all visiting ships and there are ports with a range of facilities specialised in type of ship waste stream;
2. *The definition of ships waste streams categories that can be delivered to a port reception facility and/or a waste processing facility*; most ports have adopted the definitions of ship waste streams according to the Marpol Annexes. However some ports have made subsections. In one port these subsections are made to fit to the off set of ships waste residues to the (waste processing) market. In an other port subsections are introduced following the land based waste streams.
3. *The volumes of the specific waste streams to be delivered according to the port waste fee system*; the units vary (e.g. kg, m<sup>3</sup>) as does the maximum amount that can be delivered. Differences are also found in the minimal volume ships are obliged to deliver (and therefore maximal volumes stored) based on internal guidelines as where others have no check at all.
4. *Financial structure of the ports waste fee*; differences are found in the methodology on how the waste processing costs are charged to the ship (polluter pays principle). There are systems where ships pay on delivery (direct financing) or systems where payment is made through an integrated or fixed fee (indirect financing). The latter giving a port the possibility for a financial incentive to enhance the delivery of ships waste to shore. The use of indirect financing system is mostly found on garbage. Part of the differences within the financial structure is the methodology of calculating the waste fees. Although all ports have an indirect system on garbage the ship categories used to set the calculating base differ. These bases vary from types of ships to the ranges of gross tonnage (per port different sizes are used) as well as different units (some ports use engine power where others use gross tonnage).
5. *The ratio between overall harbour costs and ships waste costs*; every ship visiting a port has to pay for the use of the quays and the harbour facilities. On top of that the ships waste costs are charged. In general the ships waste costs are low (range of 5%) compared to the total costs for

visiting a harbour. This percentage depends on the size and type of the ship as well as between the community ports .

6. *The market waste collecting companies and waste processing companies operate in;* variety is found per waste stream per country as well as per port. Different markets are formed based on a open market principle (every company willing to participate is allowed as long as they uphold national legislation) or a closed market principle (only companies that have met tendered conditions are selected by the tendering authority: the port authority).
7. *The organisation and methodology of enforcement;* each port has a collaboration with its national authorities in enforcing the marine environmental legislation. Differences are found to what extend the port authorities enforce national marine legislation. Most ports focus on the bylaws leaving the responsibility for the Marpol regulations to national authorities. The methodology used in altering non compliance behaviour differs from country to country. Some focus on strong enforcement on a selected number of topics (oily waste, storage capacity) and fines when non compliant behaviour is met, where others use financial incentives (rewards or discounts) or education and information to stimulate the wanted transition;
8. *The service level in waste collecting services;* within the ports visited a variety of service levels on waste collecting is met. For example, organising waste collection in one port is the sole responsibility of the captain. The captain must find the waste collector himself and must make sure all waste can be delivered. In another ports the harbour organisation will make sure all is arranged based upon the first pre-call to port. On arrival the captain is informed when waste collection takes place, who will perform the service and how much time is needed.

High diversity opens opportunities/gives incentives to shop and to non-compliant behaviour.

Non compliant behaviour like, for instance, littering holds a clear environmental risk. Non compliant behaviour is mostly caused by a low chance of being caught and a high (economic) incentive as delivery to shore becomes to costly (in time needed to deliver, high direct fees, a negative balance in the ratio of indirect fee and service level).

Shopping is not an environmental problem as long as all ships waste is finally delivered to shore. The level of uniformity within the inland shipping can form a useful example on how to adjust the European directive and stimulate uniformity among laws and regulations.

#### **Enforcement is not implemented to its full potential.**

The responsibility for enforcement of marine legislation is divided between ports and national authorities. As a result capacity problems and miscommunication reduces the effectiveness of enforcement. Inspection authorities have difficulties to comply to the percentage set for ships inspections in the European PRF directive. A priority system should prevent that ships with big environmental and safety risks are missed. This system is now in place through THETIS.

Inspectors rarely fine the offences met. Because enforcement is complex due to the general formulation of regulations. General evidence is mostly circumstantial and will not stick in court. The alternative to come to compliancy by educating and informing is not standard. Only on occasions where storage capacity is involved a change is noticeable and inspectors persuade (by means of arguments and communication skills) captains to deliver to shore.

Unless the waste regulations are changed into more accurate obligations (e.g. prescribed collection bins, volumes, etcetera) the impact of enforcement is limited

#### **Different stakeholders need tailored approach to alter their behaviour.**

The objectives of the stakeholders to be involved in ship generated waste differ. When current behaviour needs to be changed this must be taken into account. Only then can reduction of ocean and sea littering be achieved. The following can be stated:

1. *Government's objective* is cleaner waters by stopping/reducing the amount of littering at sea. They will achieve this by stimulating the use of (cost effective) Port reception facilities. The objectives are based on the Marine strategy framework directive.

2. *Harbour's objective* is to fulfil the (local) markets demand in harbour facilities. The better they are able to meet these demands the stronger their market position will be and therefore the profitability. As most harbours are partly owned by local or state governments a high level of social responsibility is part of their focus. As seen in the number of ports presenting itself as a 'Green port' .
3. *Ships'/ship owners' objective* is a higher turnover/profit with a minimum of time loss through waste collecting activities, documentation, waste costs and general harbour costs. Within this group of stakeholders itself are different subgroups. Cruise ships use sustainability more and more as an unique selling point, therefore waste and waste management is growing in attention.
4. *Agent's objective* is a higher turnover/profit/provision for his company and the shipping company who hires their services.

Compliant behaviour can not be achieved when these objectives are not recognised.

#### **Harmonisation of waste cost may contribute to less littering**

Waste costs forma small percentage of total harbour costs. This could imply that harmonising these limited costs will not change the behaviour of ships. However in practice shopping with waste and dumping of waste at sea does exist. Apparently for some ships even relatively low costs, possibly combined with low service level and lack off transparency, do seem to be an incentive to shop with waste and even dump waste at sea. Harmonisation of the financing systems of harbours can eliminate any financial incentive for unlawful behaviour and is therefore recommended.

#### **Functioning of ships waste market should be modified**

The waste collection and processing market is by no means a perfect market. This is not surprising as this is an environmental market with strict legal boundaries. Waste disposal is not a service one wishes to purchase but instead one which is imposed on an operator. The presence of agents is characteristic of an imperfect market. On the supply side competition is partially encouraged through tendering. Differences in efficiency in the waste management chain (e.g. the residual value of waste differs largely) and the possible lack of competition (which is then corrected by the Netherlands Competition Authority through the fining of companies) leads to serious doubts concerning the competitiveness of the supply side of the market.

#### **One European waste management system can fully eliminate any financial incentive for ships not to comply.**

Several waste management models are thinkable. It is important that a choice is made for one uniform European model. This has to be implemented in all member states. This report gives a overview of these possible models and pointers to support decision making. This will take a big effort for probably a long period of time to overcome thresholds and political resistance.

#### **Current examples of good practices**

From the interviews with the harbour representatives it has become clear that the local conditions largely determine which direction is chosen to change behaviour of involved stakeholders.

Out of the interviews with the harbour representatives the following 'Good practices' are acknowledged:

1. The 5 E's (Exemplify, Enable, Encourage, Engage and Enforce) seem a very useful strategy to change behaviour. In addition it is essential to make sure that all 5 E's are given attention to and kept in balance with each other.
2. The Marine Awareness Course is an accessible and fun way to educate ship crew. Beside that, it is an practice that is relatively easy to implement.
3. Track and information systems will become more relevant as techniques are developing and the amount of traffic is growing. The systems from Antwerp and Pireaus both are good examples that other harbours can learn from.

4. A discount is an stimulation that will encourage people to comply to regulation and behave as desired. When discounts are related to environmentally friendly actions the environment can be the winner. Financial incentives are effective as long as the incentive is attractive enough (in financial compensation and ease of use).
5. The Belfast Environmental Forum and the insight in the waste process that is presented in Barcelona are powerful developments that give companies and people a practical insight in how waste processing works and more important, how waste can be prevented by smart combinations of processes and products.

Apart of the model chosen other economical and social incentives can be used to stimulate waste delivery to shore. Choices have to be made on:

- Fiscal incentive for good waste management
- Discount on harbour fee for good waste management
- Subsidies on board treatment
- Reducing costs by improving recycling
- Inform and educate
- Innovate track and tracing systems

## 6.2 Reflection of results to the hypotheses

The two hypotheses defined for this study are:

1. The uniformity and transparency of laws and regulations on ship generated waste in all European countries with an international port might improve the disposal of waste to shore and discourage waste dumping at sea.
2. The harmonization of waste fee systems in European ports will simplify the waste disposal process and aid in the discouragement of dumping waste at sea.

The results of this study confirm the first hypothesis. As uniformity and transparency enable ship owners and ship's crew to comply with the standard set by their group (in this case shipping industry).

The second hypotheses is not fully proven. Waste costs are just a small percentage of the total harbour costs of a ship sailing to port. It is recognised, however, that shipping companies (ships crew) do shop for a cheaper or a more easy way to deliver their ships waste. Furthermore harmonisation of waste fees bypasses regional differences in costs structure for waste processing. This can undermine a overall European system. Based on these observations it can be concluded that harmonization of waste fees does contribute to a higher volume of ships waste to shore, but is not a complete solution.

## 6.3 Recommendations and discussion

The analyses of the relation between legislation, financing system and non-compliant behaviour of shipping companies and ships crew is made. Conclusions are drawn. This report is written as a discussion paper. As researchers we do not want to steer this discussion in a set direction by making a preliminary recommendation. Based on our analyses and conclusions we do recommend to start the discussion as soon as possible. This discussion has to take place with the shipping companies first as we feel that the knowledge on their needs is relatively low. At the same time start a discussion on a European level with al stakeholders represented. The agenda of this discussion needs to address the following topics:

**Uniform implementation by:**

1. Decision must be made in what way and according to which criteria waste streams are to be issued. These criteria have to be set on an uniform European level. For example on the categories waste needs to be separated in and maximum storage volumes. This must be done with an eye to the local differences in waste processing abilities.  
By this all European harbours ships crews are stimulated to comply. At the same time this might have a positive influence on waste processing costs as well through the increase of efficiency.
2. Waste handling speed, efficiency and flexibility must be improved and harmonised. Time is of importance in the shipping industry. Time wasted on waiting for waste handling will lead to an increase of littering as littering benefits increase. Decision must be made to set a standard where collectors have to oblige to. Harbour authorities can form a centre point of information where service and demands are met and organised.
3. Waste tracing system must be implemented in such way that it supports 'responsible care' of sustainable shipping companies. This system supports the waste handling speed as well by connecting pre-registered waste volumes and waste collectors.
4. Harmonise the financing system. One European financial system should be chosen. A private system or a collective system and implemented in all member states. Getting all member states to agree on this topic will take time. To support the overall discussion and speed up the process a 'first movement group' of countries and harbours can be formed that will lead to a pilot case.
5. New waste management systems should be explored. The outline of a new private system or a new collective system is described. These waste management systems are based on different financing systems and different responsibilities for stakeholders.
6. A maximum height of the waste fee in relation to the general harbour costs could be considered. Now for some categories of ships (especially small ships) cost may be more significant compared to total harbour costs. Keeping costs relatively low (in comparison to the total harbour costs) for all ships in all harbours would further reduce the financial incentive for ships to dump waste at sea.
7. The use of different forms of fines and rewards is described and should be discussed. The question is how ship crews can be stimulated to comply with established rules and regulations. The options of enforcement (fines) and positive incentives (subsidising, refunds and discounts).
8. Formulation of regulation should be strict and specific to support enforcement. Involve law enforcement organisations during the process of law making to guarantee the needed formulation.

The most difficult part of these discussion is that of uniformity. This means that local and political preferences have to be set aside for the benefit of a overall European model. Then, when this model is clear, local and political details can be implemented in order to reach a even more efficient implementation locally of the set European model acknowledgment to the different member states infrastructure.

## Appendices

### Appendix I: Selected ports and stakeholders

The following ports were visited:

Amsterdam
Antwerp
Barcelona
Belfast
Hamburg
Piraeus
Rotterdam
Stockholm

Information obtained through these visits and interviews is supplemented by information gathered through:

- an interview with a Dutch representative of Euroshore (Association of port reception facilities Europe),
- an interview with an inspector of the Dutch Inspection of Environment and Transport (Department of Ministry of Infrastructure and the Environment),
- an interview with a representative of the European commission on transport,
- an interview with a representative of the Dutch association of shipping companies,
- an interview with a senior policy advisor on Maritime affairs and Seaports of the Dutch Ministry of Infrastructure and the Environment,
- EMSA's recent study on 'The delivery of ship generated waste and cargo residues to port reception facilities in EU ports',
- position papers of the ESPO (European Sea Ports Organisation) on the Review of Directive 2000/59/EG of October 12 2011,
- Seas at Risk Position paper on Ships' waste dumping and the clean ship concept.

## Appendix 2: CDNI

The Convention has been structured in three parts:

Part A; The collection, deposit and reception of oily and greasy waste produced in operating the vessel.

- Wastes occurring in the engine room are specifically addressed. Such wastes are generally the same for all inland vessels. The amount of the wastes occurring depends on vessel use. The technical equipment and the condition of the machinery are also factors affecting the amount of waste. Consequently, inland vessels vary in terms of how frequently such wastes have to be deposited. There is an indirect finance system for all countries equally. Each ship pays a fix amount multiplied by the amount of use of gasoil and can therefore give this waste further free of charge.

Part B; The collection, deposit and reception of cargo related waste

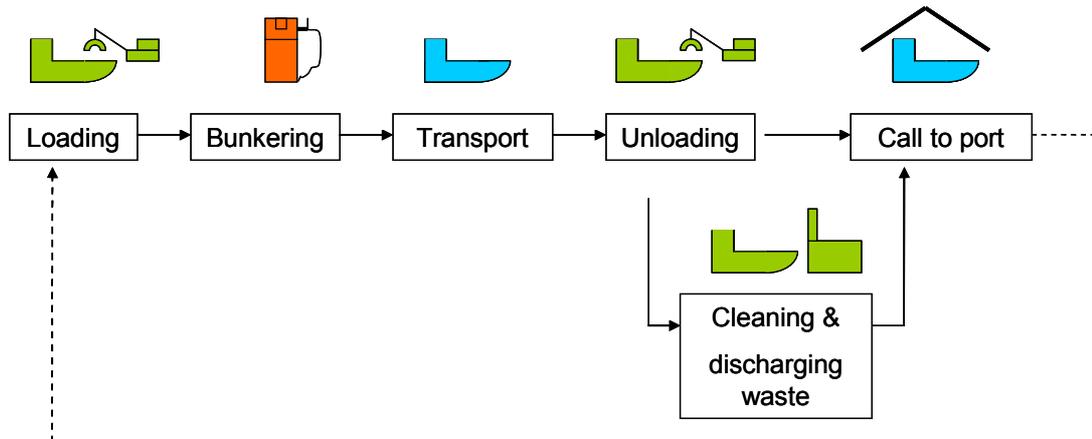
- Regulation for cargo residues makes arrangements for handling cargo residue and waste that are due to the shipment of cargoes. Cargo is a large source of possible waste and wastewaters. In relation to every cargo switch, the tank must be cleaned out with regard to the previously transported cargo to prevent the new cargo from being contaminated. Not all cargo types are sensitive to the contaminants that may possibly result and all cargo types have the same potential effect on the environment, therefore different types of cleaning methods are prescribed. Regarding to the “polluter-pays” principle, the Convention is based on the shipment contracting party. This party, after all, is the one that has the knowledge and resources to optimize the discharging process and therefore responsible for the costs that are involved in this process.

Part C; The collection, deposit and reception of other waste produced in the course the vessel, comprising sewage and garbage

- This part of the regulation aims at realizing a provision level and financing form in the different countries that are comparable with the collecting facilities on shore. Therefore there are no restricted rules as long as it is implemented in the form that is set by the objectives of the Convention by encouraging prevention, providing reception facilities and setting up funding. Regarding to reception facilities and funding; easily accessible deposit dedicated points at locations near where the vessels are moored and fixed funding that is integrated as much as possible into other existing payment obligations. This will ensure that household waste at ports can be deposited and that a direct payment for this will not be required but that costs are covered by the payment of port dues or other financing systems. The deposit of small-scale hazardous waste is also free of charge in many cases but a contribution may be demanded. Specific regulation is applied for household wastewater, based on a discharge prohibition for vessels that can accommodate 50 or more passengers.

This discharge prohibition can be applied using two methods:

- Storage on-board in tanks for wastewater set up especially for this purpose and disposal of this water at the port (connection to the sewer system or other system);
- Treatment on-board using a permitted on-board water treatment system; the purified water fraction may be discharged to the surface water. Treatment sludge that is produced during this process must be disposed of by companies that have been accredited for processing this kind of waste.



**Figure 5: Waste value chain recognized in the CDNI for inland shipping**

The CDNI has tailored its regulations to the activities as shown in the boxes of figure 2:

- Loading: What measures should be taken to prevent the generation of waste by spills. Regulated in Part B of the CDNI.
- Bunkering; Oily and engine room related waste. Regulated in Part A of the CDNI.
- Transport; during transportation water can come in to the engine room and stay in the bilge and create waste. This is also a matter of part A.
- Unloading; in the unloading process waste should be prevent as much as possible by adding all cargo residues as much as possible to the cargo. Regulated in Part B.
- Cleaning process; In relation to every cargo switch, the tank must be cleaned out with regard to the previously transported cargo to prevent the new cargo from being contaminated. Not all cargo types are sensitive to the contaminants that may possibly result and all cargo types have the same potential effect on the environment, therefore different types of cleaning methods are prescribed. Regulated in Part B.
- Call to port; all waste, which originates because the ship is being used and is not considered as part A or B, can be identified as other waste and is regulated in Part C.

### Appendix 3: Overview of financing systems and harbours and markets visited

Financing/ harbour.	A	B	C	D	E	F	G	H
<b>Indirect financing</b>								
Percentage of total financing	Hybrid 1: 100% 5: small No % available / possible	Hybrid 1: 5: 100% No % available (maybe possible)	100%	Hybrid No percentage available	Hybrid	Hybrid 1c: 100% 5: 100% 1a en 1b: 0% private	Hybrid 1: 100% 5: 100% (cruises. separate regulated)	Hybrid
Basis	GT	Engine Power (I and V)	GT (discount green ships))	GT	GT	National law and taxes	GT	GT
<b>Waste streams covered</b>								
Annex I	Yes (%col high)	Yes (% col low lack of bilge vessels)	Yes	Yes	Yes	No (partially)	No	Yes
Annex IV			Yes			Yes		
Annex V	Yes (%col low)	Yes (% col rel. high, service and height of max.)	Yes	Yes	Yes Col very high, cheap	Yes	Yes	Yes
Maximum quantity	Yes 1: related to storage capacity 5: storage capacity not well described	Yes 1: euro (1500) 5: in m3 (6)	No	Yes 1: in m3 5: in m3	Yes 1: euro ( 1100) 5: euro (900)	Yes but high limits (5), 1a en 1b n.a. 1 c: no limit	Yes 1: low 5: high (in skips practice no limit)	Yes
<b>Specification</b>	Deposit and refund							
Percentage of total harbour costs	5%	Big ships 5% Small ships >5 %	Small percentage Estimated 5-10%	Small percentage	Small percentage Estimated 5-10%	Small percentage Estimated < 5%	Small percentage Estimated < 5%	30%
<b>Direct financing</b>								



Tarif	<i>Euro per ton</i>	<i>Euro per ton</i>	<i>Euro per ton</i>	<i>Euro per ton</i>	<i>Euro per ton</i>	<i>Euro per ton</i>	<i>Euro per ton</i>	<i>Euro per ton</i>
Annex I	market information not public	market information not public	n.a.	market information not public	market information not public	market information not public	market information not public	market information not public
Annex IV	Idem	Idem	n.a.	Idem	Idem	Idem	Idem	Idem
Annex V	Idem	Idem	n.a.	Idem	Idem	Idem	Idem	Idem
<b>Financial result harbours</b>	Negative	Negative (1 mln)	Negative (2 mln.)	1: Break Even oil 5: ?	Negative (0,2 mln)	Negative (4 mln.) (ca min. 10.000 ships movement)	Break Even (getting negative)	Break Even

## Appendix 4: Example of fees

### Example

A ship with a registered capacity of 10000 GT and an engine power of 9000 kW  
 Ships type is bulk carrier  
 Ships waste is 2 m<sup>3</sup> of garbage, 5 m<sup>3</sup> of bilge and oily waste.

Harbour	Waste fee
<b>A</b>	€ 130,00 Fixed fee
	-€ 30,00 Garbage compensation
	-€ 150,00 Oil compensation
	-€ 50,00
<b>B</b>	€ 15,00 Administration fee
	€ 275,00 Garbage; not exceeding the limit
	€ 200,00 Oily waste
	€ 490,00
	-€ 150,00 Discount when SHW is in place
	€ 340,00
<b>C</b>	€ 603,72 Garbage
	€ 243,81 Oily waste; When bilge has a % of water >25%
	€ 847,53
<b>D</b>	€ 105,00 Garbage: max 720ltr; left over 1,280 m3 via private market
	€ 140,00 Oily waste: No extra charge not exceeding limit
	€ 245,00
<b>E</b>	€ 300,00 Limits are based on costs, it is not known what volume corresponds to the prescribed costs
<b>F</b>	€ 1.056,00 One price for all waste streams within the indirect financing system
<b>G</b>	€ 228,60 Garbage
	unknown Oily waste; Private company direct finance
<b>H</b>	€ 600,00 Liquids (sewage and oily waste)
	€ 300,00 Garbage
	€ 900,00
	-€ 720,00 80% discount on delivery
	€ 180,00

### General harbour costs

Harbour costs are based on different services provided by the harbour organisation; e.g. use of key, towing services, port security, handling costs depending on the substance at hand. These costs run up to thousands of Euros per day.