Oil spill response in port areas : governance and the polluter-pays principle

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Oil spill response in port areas: Governance and the polluter-pays principle

1. Introduction

Spills in ports are usually small but are in confined areas. They commonly arise from equipment malfunctions that can be attended to quite quickly, bunkering equipment misshandling or are associated with accidents usually involving small vessels. Aggregate data on the occurrence of spills in ports is absent. Spill events are recorded by different agencies among the ports studied but data are too disparate for convenient summation. However, while the spills are small, the potential for serious harm is high because of their proximity to shorelines with a range of environmental, economic and social activities. The spills are also very visible to the local population. As a consequence, the effects of governance regimes on the effectiveness and cost burden of spill response warrants attention by maritime economists. The research reported here is an initial investigation of issues associated with spill response in ports.

The resources required and level of authority needed to respond to oil spills in ports are affected by many features of spills. They include the quantity and nature of the oil spilled, the location in relation to sensitive areas, the weather and the water conditions. In general, oil spills in ports are categorized into three levels, sometimes called tiers (IPIECA-OGP, 2015). First, there are spills that can be contained and cleaned up by the responsible party (RP), such as a liquid-bulk terminal, bunkering operators or shipping lines. Second, spills that exceed the capability of the RP so that a response organization (RO) is called out and a higher level of lead authority may assume responsibility for response management are tier 2 spills. And third, ports can be confronted with spills that require a response drawing on national resources and authorities comparable with spills in territorial waters. The response to the second category of spills is the central topic of this research.

Academia defines ports as “a transport node where different transport means meet each other” (Verhoef, 1981) or “as the place where normally seagoing vessels enter in order to disembark or take on board cargo, passengers or crew” (van Hooydonk, 1996; Somers, 2004; De Decker, 2015). This research uses the term ‘port area’ to indicate a geographical area. A port area refers to the land and water area under the responsibility of the port authority (PA) including neighbouring marine domains (dock, river, canal or navigable lake with access to a sea or ocean) serving terminals that are under the jurisdiction of other agencies but, where the authority’s jurisdiction does not extend to tier 2 marine spills. This definition is necessary to encompass two situations: the first is to refer to areas where the PA has no jurisdiction over the

water body, as in the US (which accounts for the absence of harbour masters in American PAs); the second is to include the zones where the responsibility of the PA is confined to marine areas close to the port land, leaving navigation channels to other agencies, as in Antwerp (Belgium).

The spill response regimes are developed nationally to be consistent with international conventions. The spill response regimes for small spills in ports fit under the respective national regimes but variation of the governance structure of ports among countries gives rise to differences in the administration and incidence of the response to spills. There currently is no systematic study of spill response in ports, a shortcoming tackled in this research.

The research is a comparative analysis of spill response in eight ports in six countries. The ports are Antwerp (Belgium), Rotterdam (The Netherlands), Hamburg (Germany), Southampton (UK), Long Beach, Seattle, Houston (USA) and Vancouver (Canada). The ports of Antwerp, Rotterdam and Hamburg were selected as major ports, in close proximity but operating under different national regimes of spill response and port administration. Southampton was selected based on its location in a highly sensitive environmental area with the presence of a leading UK oil refinery and a major container terminal in its waterway. The UK also has distinctive institutional arrangements, including private ownership of its ports; while the other European ports use a landlord port model (Verhoeven, 2010). The ports of Seattle, Long Beach and Houston were selected because they have contrasting port environmental conditions, port communities and port traffic while operating under the same national emergency response regime. The port of Vancouver operates in a comparable federal political regime as the US ports but with different national response regimes and different responsibilities for PAs. Also, an oil spill incident in Vancouver in 2015 was the first impetus for major reviews of the oil spill response regime in Canada.

The polluter-pays principle refers to the practice of whoever produces pollution should bear the costs it generates (Gaines, 1991). This principle has worldwide recognition and is referred to in national legislation, regional and international declarations and agreements (Stevens, 1994). Academia studied the implementation mechanisms for setting this principle in practice and its implications (Eskeland & Jimenez, 1992; O'Connor, 1997; Nash, 2000). Liu, Wirtz, Kannen and Kraft (2009) researched the willingness of households to pay to prevent coastal resources being polluted by oil spill. However, no studies have investigated the varied means by which the principle is applied to cost recovery for oil spills in port areas.

Figure 1 outlines the amount of liquid bulk cargo and the number of sea-going vessels handled in 2015 in each of the studied ports. The former is related to the potential for large spills. The latter is related to the potential number of spills.

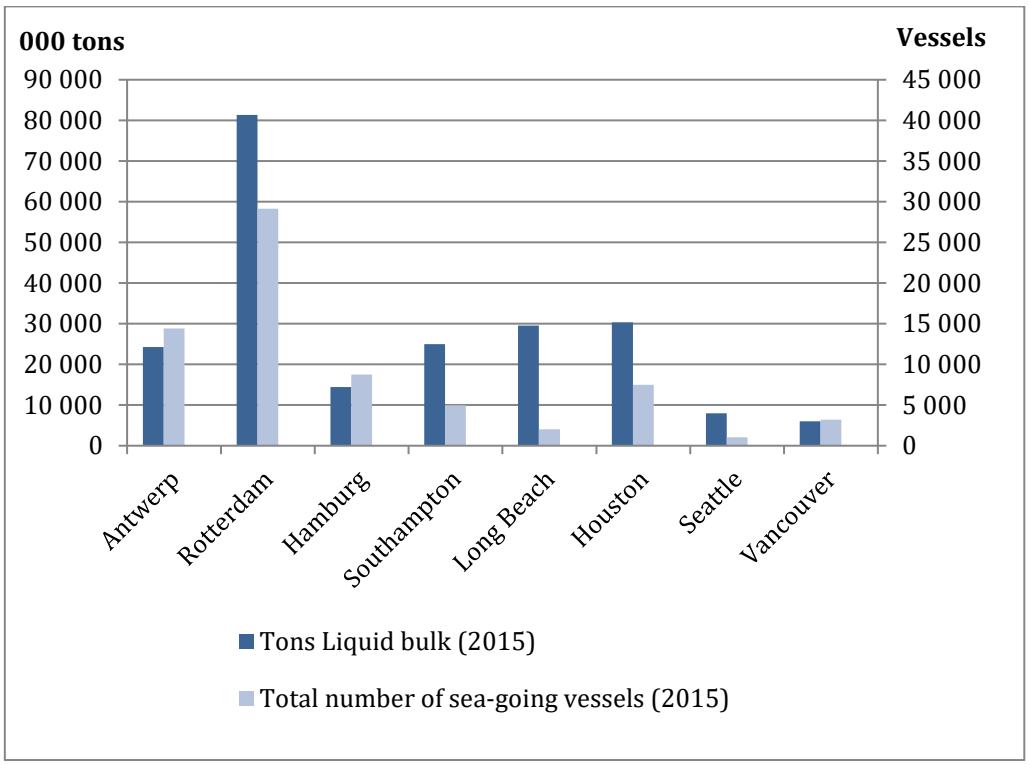

Figure 1. Amount of liquid bulk cargo and total sea vessels handled by the studied ports.

Source: own composition based on PA information

Figure 1 shows that the quantity of liquid bulk cargo handled in the ports varies from 6 thousand to 81 million tons in the port of Rotterdam. The annual number of vessels which call at these ports is relatively high. While in the port of Long Beach, approximately 1,000 sea-going vessels call each year, in the port of Rotterdam, there are 30,000 sea-going vessels. These elements contribute to the risk profile for oil spills in and around these ports and consequently set the requirements of the spill response procedures and capabilities.

Using these ports as case studies, the current research addresses the following questions:

> RQ1: What are the different governance structures, planning processes and operating practices for oil spill response in ports?
> RQ2: What are the implications of different port governance regimes and different operating strategies for the application of the polluter-pays principle?

The structure of the paper is as follows. Section 2 summarises the research strategy followed. Section 3 provides an overview of the agreements and conventions at the global and European level that are vital to spill response practices. Section 4 outlines the main differences and similarities between oil spill response practices. The conclusions and recommendations for future research are in Section 5.

2. Research strategy

The research commenced with a two – part literature review. The first part was of the substantial research on the technical aspects of marine oil spills and clean up and recovery methods to provide an effective foundation for subsequent interviews and to identify the generally recommended elements of spill response practices. The second part was to document the legal international framework for oil spill responses which establishes the obligations of nations. The literature review provided the basis for a programme of interviews with managers involved in various aspects of spill response in the selected ports carried out in the period of June - November 2016. The interviews were semi-structured discussions to elicit information on the role and the processes of organizations in oil spill response planning and response in the port. The survey design is added in Annex A. The interviews were with individuals in different roles and organisations reflecting the differences in the national and port regimes, shown in Annex B. The interviewees were representatives of port authorities, government departments and companies with responsibilities in spill response. In particular, representatives of the port authority, harbour master, civil protection, local police and specialized oil cleaning companies were interviewed. The length of interviews depended on the role of the organisation in spill response and varied between 45 minutes to two hours. The interview design enquired about the role and the processes of the respective organization in oil spill response planning and preparedness. It dealt with the wide range of activities which may be required to be undertaken in the event of an oil spill. Furthermore, the problem of financial spill implications was also addressed. The information gathered through the interviews enables a comparison of the processes by which response planning takes place, the allocation of responsibilities during response and the consequences of responsibilities for cost allocation, or the application of the user -pay principle.

3. Literature review

The first phase of the literature review covered the technical and organisational aspects of spill prevention and response in order to communicate effectively with interviewees and to identify critical elements of spill response related to governance. The second phase covered international conventions and agreements.

3.1 The technical literature

The technical research reviewed deals mainly with assessment aspects of spill response. Reed et al. (1995) put forward a tool for quantitative, objective assessment of alternative technical oil spill response strategies. Parker (1997) takes a structural approach to investigate the causes and the effects of oil pollution. Ventikos et el. (2004) come up with a decision-driven process, which can provide for a realistic choice of oil spill response equipment in the design of the primary oil response phase. In parallel, Bergueiro et al. (2007a) report on the importance of the swell, the meteorological conditions and the marine currents to the physical properties of spilt oil. As well, Bergueiro et al. (2007b) note the spectacular advances in simulating spill

characteristics. These tools allow predicting a series of outputs related to the spill trajectory, the minimum impact line and the impact point of a spill. Doerffer (2013) adopts a marine perspective to discuss the problems of different types of oil spills. Equally, there is a substantial literature on oil spills in conference proceedings such as those of the International Oil Spill Conference (IOSC).

Industry has also made efforts to develop knowledge around oil spills and put forward substantial literature on the required features of effective response. This includes guidelines in the publications of the following organizations:

- The Regional Association of Oil, Gas and Biofuels Sector Companies in Latin America and the Caribbean (ARPEL) has developed the "Response Evaluation Tool for Oil Spills" (RETOS). RETOS provides an easy-to-use series of checklists with criteria for oil spill preparedness (ARPEL, 2014).
- The International Tanker Owners Pollution Federation (ITOPF) has a set of 17 technical information papers related to oil pollution, including a paper on "Contingency Planning for Marine Oil Spills" (ITOPF, 2014).
- IPIECA-OPG, has a number of publications as a part of its Good Practice Guide Series which summarizes current views on good practice for a range of oil spill preparedness and response topics (IPIECA-OGP, 2015).
- The International Maritime Organization (IMO) supports an extensive programme which includes manuals, guidelines and courses on the prevention and response to oil pollution (IMO, 2016b).

There is no single 'best way' to prevent and respond to oil spills but three important attributes were selected for investigation in the interview programme (Nuka, 2013). They are: the contingency planning process is clear and involves all relevant parties; there is an effective framework to ensure the availability of sufficient equipment and personnel; and the incidence of costs is consistent with the polluter-pays principle.

3.2 Global and European oil pollution conventions and agreements

International conventions are fundamental to the national policies and regional international agreements that govern oil spill response systems. This section reviews the international conventions prior to considering regional agreements.

3.2.1 Global conventions

Oil spill response in ports around the world is carried out in the context of national policies that have been influenced significantly by global events and conventions. The conventions of IMO have generally been triggered by major spills. Annex C is a listing of IMO conventions relating to environmental protection (IMO, 2016a). The conventions are divided in two categories: those relating to the prevention of pollution and those relating to liability and compensation.
The early (1969) and subsequent attention to polluters' liability, in the International Convention on Civil Liability for Oil Pollution Damage, is evidence of three aspects of the polluter-pays principle at work. First, some limits are needed on the liability of individual vessels for the

viability of international shipping businesses. Second, as a result of such limits, industry and governments have developed additional mechanisms to build up funds for compensation payments. Third, the focus is on the recovery of response costs associated with individual events which leaves the coverage of stand-by or preparedness costs to national practices, as considered later in this paper.

The first catastrophic oil spill was in 1967 when the *Torrey Canyon* ran aground, spilling some 119,000 tons of oil. It was a wake-up call. However, much of the ensuing attention focused on arrangements to ensure compensation for those affected by pollution and on measures to control operational discharges of oil.[1] Only some national and regional response plans emerged.[2] It was the grounding of the *Exxon Valdez* in Prince William Sound, Alaska in 1989, spilling some 35,000 tons of oil, which finally led to global action on spills. The requirement for double-hulled tankers was the most significant preventative measure introduced as a requirement (for future US trade) by the Oil Pollution Act of 1990 (OPA 90) and internationally by amendments to the International Convention for the Prevention of Pollution from Ships (MARPOL) in 1992. The most profound measure for spill response was the International Convention on Oil Pollution Preparedness, Response and Co-operation (OPRC) adopted by the IMO in 1990. It came into effect in 1995.

The focus of OPRC is on "oil pollution incidents", defined as an occurrence which results or may result in a discharge of oil and which poses or may pose a threat to the marine environment or to the coastline or related interests, and which requires emergency action or other immediate response.[3] While large spills accounted for the convention, OPRC sets out a comprehensive and global framework for dealing with marine oil spills. The convention takes into account the 'polluter-pays' as a general principle of international environmental law. Article 6 of OPRC, which outlines the national and regional requirements for preparedness and response systems, is presented in Annex D. OPRC also requires oil tankers of more than 150 Gross Tons and all other ships exceeding 400 Gross Tons to carry a Shipboard Oil Pollution Emergency Plan (SOPEP).

3.2.2 Cooperation agreements at European level

OPRC requires all states to have an authority to request assistance or to decide to render the assistance requested. This can be exemplified by the response of European countries to their experiences and proximity by entering into five regional agreements. These agreements enable coordinated plans for the pollution preparedness and responses in case of a large-scale marine incident.

[1] The International Convention for the Prevention of Pollution from Ships (MARPOL 73/78).

[2] The first national contingency plan was published in the US in 1968. It provided a comprehensive system of accident reporting, spill containment and cleanup. The plan also established a response headquarters, a national reaction team and regional reaction teams (EPA, 2016).

[3] The authority to act when an incident *may result in a spill* is important to ensure timely action under the obligations of the responsible party for costs.

Table 1 lists these agreements and the participating countries. Ongoing response and legislative issues in Europe led to the establishment in 2002 of the European Maritime Safety Agency (EMSA). EMSA has wide ranging policy and operational responsibilities. It has a fleet of 18 contracted vessels, available to member and near-by states, to reduce mobilization times, and to improve technological, recovery and vessel storage capabilities. The resources of EMSA may be deployed by Member States when the response capabilities at national level are overwelmend and potential damage to neighbouring areas is present.

Table 1. European regional agreements on oil pollution.

Region	Agreement	Year signed	Countries participating
The North Sea	Bonn Agreement	1969	Belgium, Denmark, France, Germany, Ireland, The Netherlands, Norway, Sweden, and the United Kingdom
The Baltic Sea	Helsinki Convention (HELCOM)	Originally signed in 1974 (new adoption in 1992)	Denmark, Estonia, Finland, Germany, Latvia, Lithuania, Poland, Russia and Sweden
The Mediterranean area	Barcelona Convention	Originally signed in 1975 (new adoption in 1995)	Albania, Algeria, Bosnia and Herzegovina, Croatia, Cyprus, Egypt, the European Community, France, Greece, Israel, Italy, Lebanon, Libya, Malta, Monaco, Montenegro, Morocco, Slovenia, Spain, Syria, Tunisia and Turkey
The North East Atlantic	Lisbon Agreement	1990	Portugal, Spain, France, Morocco
The Black Sea	Bucharest Convention	1992	Romania, Bulgaria
The extended North-East Atlantic	OSPAR Convention	1992	Belgium, Denmark, Finland, France, Germany, Iceland, Ireland, Luxembourg, The Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom

Source: own compilation of non-exhaustive sources based on (EMSA, 2016)

4. Comparative analysis of oil spill governance and practices in ports

National policy frameworks are the basis for the governance structure of oil spill response in ports. These frameworks determine the lead organization responsible for contingency planning and response execution. In the case of UK, the actions of the lead organisation are subject to overview processes; contingency plans are approved by the Maritime and Coastguard Agency (MCA) and clean-up is monitored by the Agency. Oversight is not as evident in the other countries, where agencies such as PA's in Europe or coast guard in US (USCG) and Canada (CCG) are responsible for response plans.

The following text focusses on the role of the lead organization in each of the ports selected for analysis.

4.1. Lead response agencies for oil spills in ports

The planning and execution of contingency plans for oil spills have to be collaborative processes because of the complex interactive nature of spills in the marine environment. Initial responsibility rests with the polluter, the– RP, but in the event that the RP is unwilling or unable to lead a response in an effective manner as judged by a lead response agency, then that agency assumes control. The (reasonable) costs incurred remain to the account of the RP. However, lead response agencies work in committee structures but need to have the authority to make decisions in the event that agreements cannot be reached. National policies prescribe these agencies. The resulting organisation regimes are the foundation for the governance structures and operating practices for oil spill response in ports. Table 2 shows the lead agency for response for oil on the water and reaching land within a port area.

Table 2. Lead oil response agency in ports

Port/country	**In port area**		**Beyond port area**	
	On water (docks, locks and/or port basin)	**On shore/ terminal land**	**On water (river, chanel or navigable lake)**	**On shore (port area surrounding land)**
Antwerp/ Belgium	Public PA	Public PA	Regional (province) government	Regional (province) government
Rotterdam/ The Netherlands	Public PA	Public PA	National government	National government
Hamburg/ Germany	Local authority, Environmental Department			
Southampton/ UK	Private PA	Local authority or private landowner	Maritime and Coastguard Agency	Local authority
Long Beach, Houston, Seattle/ US	US Coast Guard	Regional (state) government	US Coast Guard	Regional (state) government
Vancouver/ Canada	Canadian Coast Guard	Regional (province) government	Canadian Coast Guard	Regional (province) government

Source: own composition

The regimes are highly diverse. In the US, the Coast Guard is the national designated authority; PAs have no responsibilities beyond the terminal land that they own except, in some cases, for marinas for private boats. In the event shorelines are affected, at the tier 2 level, state agencies are responsible for clean up. In Vancouver, although the PA has jurisdiction over the water body in wide areas beyond terminals, the designated authority for oil spill response is the federal Canadian Coast Guard. Pollution to the shore comes under provincial jurisdiction. In Hamburg, the Environment Department of the city, also a Federal State, is responsible for spill

response along approximately 30 km of the Elbe river and the shoreline, irrespective of its use. In Antwerp and Rotterdam, the PA has jurisdiction for its lands and for the water body adjacent to the port land. Pollution extending beyond these areas and in access channels without abutting port land is the responsibility of the regional and national governments respectively. It is interesting that the widest extent of responsibility for PAs is the UK where major ports are private. In Southampton, Associated British Ports (ABP) has jurisdiction for a water body extending many miles beyond the PA's property so that adjacent land includes public and private land, including port uses (e.g., Esso's large Fawley oil terminal). Responsibility for clean up if pollution reaches the shore lies with private landowners and local governments. Irrespective of the lead response agency in ports, the communities of which the ports are a part have an important interest in the incidence of spills and the effectiveness of response to them. As a result, effective communication has two important but different roles in spill response. The first is to ensure effective involvement of the local community and knowledgeable parties in spill response planning. In the cases of the UK and the US, this is achieved through mandated consultative processes before the completion and public release of spill response plans. In Antwerp and Rotterdam, where the ports are publically managed, the liaison between the port authority and city and regional authorities is so close that no formal processes are mandated. In Hamburg, environmental responsibility lies with the Environment Department of the city/state of Hamburg so that planning for the port is embedded in the general environmental planning processes. In Canada, there has been an absence of effective community involvement in response planning which contributed to the initiation of this research. It is a shortcoming that is now being addressed under a new Oceans Protection Plan.

The second context in which communication is vital is to ensure that the public is properly informed through a well-managed public information process in the event of a spill. The management of information is an important element in spill response. Effective communication is an essential goal of any response plan. It must not be neglected in the necessary attention to the challenging tasks of dealing with a spill which in all the ports studied is performed by a specialized RO.

4.2. Response organization

The response organizations for oil spill interventions inside ports can be private contractors, public agencies or oil spill response corporations. The latter is constituted through associations of liquid bulk companies. Table 3 shows the ownership of spill cleaning equipment in the studied ports.

Table 3. Ownership of oil spill intervention equipment.

Port/country	Owner of oil spill cleaning equipment		
	Private contractor	Public agency	Industry organization
Antwerp/ Belgium	✓		
Rotterdam/ The Netherlands	✓		✓*
Hamburg/ Germany	✓	✓	
Southampton/ UK	✓		
Long Beach, Houston, Seattle / US	✓		
Vancouver/ Canada			✓**

Source: own composition (Notes: *Liquid bulk terminal operators; **Oil industry owned corporation)

In all ports, all terminals and companies handling oil have the capacity to handle small (Tier 1) spills. As seen in Table 3, the cleaning responsibilities for Tier 2 oil spills are mainly outsourced to RO, private companies which typically offer a range of product and other emergency services beyond ports. Terminal operators and others seeking protection against spills usually contract with an RO. Ships, required to have response plans when entering a port, typically have plans to use an RO through their port agents. However, other~~e~~ agencies commonly own limited containment capacities. In Rotterdam, for example, extra cleaning equipment can be used to back up the capacities of the RO. An association of liquid bulk companies active in the port of Rotterdam has started a fund dedicated to cover the maintenance cost of extra oil booms. These booms are strategically located in the port area and would be used in the event that the oil containment capacities of the private contractor are insufficient. The decision to make use of these capacities rests with the lead response agency. In Hamburg, the local authority responsible for oil spill response also owns oil spill cleaning equipment but primary reliance is placed on the contracted RO. In contrast, the Canadian practice is fully based on a RO corporation whose shareholders are oil industry companies.

The outsourcing of the cleaning service requires setting into place a cost recovery system. Regardless the port practice, the RP is always liable for the intervention expenses. However, in Antwerp, where the PA always leads the response process, the PA plays a lead role in the cost recovery process as outlined in Figure 2.

From Figure 2, it can be observed that the PA initially pays the cleaning costs to the RO. When the RP admits its responsibility, the PA initiates the process of recovering the intervention costs. In the contrary situation, the PA initiates an investigation to determine the RP. The reason for this practice is to ensure a cleaning service is provided by the RO that respects a certain PA quality level at a monitored price. By regulating the service delivered, it is believed a fair and fast cost recovery scheme is ensured. This way, the RP benefits from the experience and the neutral position of the PA with regard to cleaning costs. Equally, the RO recovers its cleaning expenses faster. This practice differs from that in other ports, where the RO recovers its expenses directly from the RP if the RP has contracted with the RO. If the RP defers to manage

the spill, the lead agency has the contract with the RO and will then bill the RP. The recovery of the costs can be contentious!

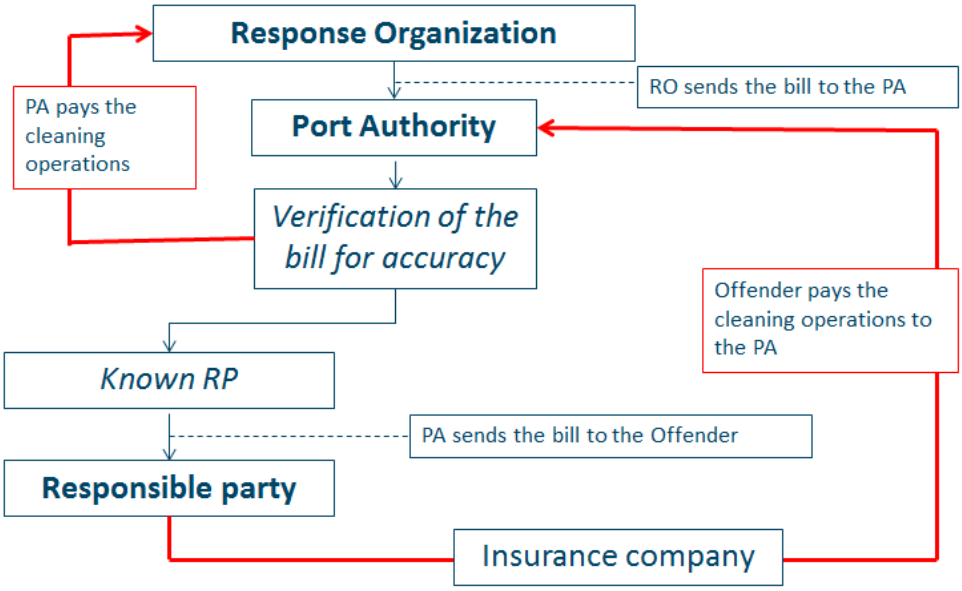

Figure 2. Cleaning cost recovery: the port of Antwerp case.
Source: own composition

The next section discusses the ramification of the structure of oil spill costs and the applicability of the polluter-pays system.

4.3. Cost ramifications and polluter-pays system

The polluter-pays principle is deeply embedded in national laws and international aggreements. In principle, the total costs of pollution should be covered by the polluter to ensure an efficient allocation of resources is achieved taking into account the environmental consequences of economic activities. The results of inadequate cost recovery are excessive output of polluting goods and services and diminished output of other goods and services. In each of the countries studied, the principle is a part of national policy. However, it is not applied to the costs in the public oversight of the spill response system, for example, general coast guard costs, nor to public costs arising from response exercises that are a vital part of response readiness.

Application of the polluter-pays principle reflects the structure of the costs of ROs and different national preferences derived from policy preferences and commercial practicality. This research indicates that commercial practices involve compromises in the application of the polluter-pays principle. The structure of the costs of ROs and the ways in which those costs are recovered are critical.

In ports, other than terminals with their own response equipment, ~~the latter~~equipment and personnel are dominantly the responsibility of the RO[4]. Their costs may be categorized in two different ways. The first way is to distinguish among the costs to provide the capacity to serve and the costs of a spill response event. The costs necessary for the clean-up service to exist may be called the 'preparedness' or the 'stand-by' costs. The latter is used here. The costs directly associated with a response are called the 'response costs' here. The second view of costs is the usual distinction of fixed (or constant) and variable costs. They may be applied to stand-by and response costs. Recognition of this distinction means that some costs may have a life which exceeds the duration of one response. These costs raise comparable issues as the stand-by costs for assignment to individual spills and polluters.

The polluter-pays principle requires that the total costs of pollution response should be covered by the polluter. Whether this is achieved in practice varies with the governance and practices guiding spill response. In principle, all the negative effects produced by oil spills should be assigned to the account of the polluting party. Putting such a system in place is complex and difficult. Table 4 shows the party with financial responsibility for the response and for the stand-by costs. Stand-by costs are associated with facilities, technologies and labour, including the ROs' costs of exercises, while response costs are the costs for response equipment and personnel used in a response, as commonly listed in published tariffs.

Table 4. Comparison of financial responsibility for costs recovery

Port/country	Polluter is liable for response costs	Source covering the stand-by costs
Antwerp/ Belgium	✓	Included in response price
Rotterdam/ The Netherlands	✓	Port Dues
Hamburg/ Germany	✓	Local authority budget
Southampton/ UK	✓	~~Client~~ Oil trade and client ~~contract~~ fees
Long Beach, Houston, Seattle / US	✓	~~Client~~ Oil trade and client ~~contract~~ fees
Vancouver/ Canada	✓	~~Client contract~~Oil trade and client fees

Source: own composition.

As expected, Table 4 shows that the RP is liable for the response costs in all of the ports. To the extent that possible costs affect behaviour, safe shipping is encouraged. However, differences exist among the ports in the way and the level of recovery of stand-by costs. In the Canadian case, where the ROs are oil company owned, revenue to cover stand-by costs (which includes a return on capital) comes from a per ton fee on the oil shipped, and a lesser amount

[4] Certain agencies such as terminals have their own equipment and personnel available for spill response. Such costs are not considered further here.

comes from an annual fee on ships, meeting their spill response plan obligations, and from port businesses choosing the economics of a long-term contract. The fee on the oil shipped is a burden on producers and consumers of oil depending on demand and supply elasticities. It is a cost-effective way to raise money but it is not a cost to shipping; it provides no incentive for clean shipping. The fee for ships and port businesses is akin to insurance that enables protection to be available if a spill occurs. It does not induce safe shipping. In the US ports and Southampton, the ROs have contract fees for their shipping and other clients, so that stand-by costs are born by shipping and other maritime interests in general. In Antwerp, the RO relies on clean-up fees to cover both response and stand-by costs. This appears to be possible because of the diversity of associated businesses of the RO but might imply that some of the costs of maritime readiness are born by other parties. In the port of Rotterdam, the RO enjoys a fixed stand-by income from the PA so that the oil trade and potential polluters are subsidised by other trades. In Hamburg, the stand-by costs are covered from the city's budget so that those contributing to the city's revenue through taxes and other means are providing the subsidy.

5. Conclusions and opportunities for further research

The research has found wide differences in the governance structures affecting oil spill response in ports. They are associated with different responsibilities in response planning and management and in the cost recovery strategies. Concluding remarks are provided with regard to the governance structures and the managerial responsabilities for oil spill response in port areas, the polluter-pays principle, policy recommendations, and opportunities for further research.

Governance structures and managerial responsibilities

National policies define the broad differences in the spill response practices in the eight ports studied but local geographic conditions and traffic composition affect actual behaviour.

The diverse responsibilities of port authorities. The functions of PAs in respect of spill response vary greatly. In five of the ports, the PA is not responsible for spill response in the waters used by vessels to serve the port. In the US, the PAs' jurisdiction extends to the dock face. Conditions on the water are the responsibility of the US Coast Guard. In Vancouver, while the federal port corporation is responsible for managing the federal land and waters under its jurisdiction to enhance trade and protect the environment, responsibility for spill response is with the Canadian Coast Guard. In Hamburg, responsibility for environmental conditions rests with the Federal State (and City) of Hamburg. It has assigned responsibility for land and marine spills to its environment department. In three ports, the PA has management responsibilities for spills incidents. In Antwerp and Rotterdam, the PA is responsible for the waters adjacent to port land but in Southampton the PA is responsible for the safety and environment of the waters under its jurisdiction which extends beyond the port land. The study makes evident the dichotomy between a port viewed as a corporate entity managing only designated port resources or as a body of water and terminals used by ships.

The diverse conditions of community engagement: Community engagement is vital in response planning to enhance the knowledge base for planning and to develop priorities to guide responses to spills. It is inherent in the structure in Hamburg since the responsibility lies with the State's Environment Department and is facilitated in Antwerp and Rotterdam as the ports are community-owned. The PAs of the US ports in this study are community ports but have insignificant responsibility for spill response. Detailed engagement practices are required under federal regulations as is the case also in the UK where ports are private. Engagement practices are still evolving in Canada.

Traffic composition, geography and spill response: Traffic composition (together with the local geography) can be expected to affect spill response management. A high incidence of oil and chemical traffic can be expected to be linked with elevated protection against and, perhaps, experience with oil and chemical spills. Whether it is because of an acceptance by the public that the response system works well or that the community accepts the risk (or is immune to it) as a part of the cost of the port's and community's business, the need for a public reporting element of spill response appears low in Houston compared with Los Angeles and Seattle. However, this research did not attempt to measure community attitudes to spill response in their port.

The polluter-pays principle

The research reveals challenges in the application of the polluter-pays principle in the recovery of response costs for tier 2 oil spills in ports. The challenges arise from the nature of RO costs and of the revenue opportunities by which to cover those costs.

Recovery of stand-by costs: As with all emergency response services, stand-by costs are necessary but incurred in the hope that the services are not or only rarely used. The interest of all potential users in the existence of the service, in case it is they that need it, means that they are 'willing' to pay. Three patterns exist for the recovery of these costs. The first is fees on industry sectors, as in Canada. The second, as in Antwerp, is where the stand-by costs are able to be covered in (allocated to) unit prices. For spill response companies, this likely means that they have significant other businesses that can use many of the resources required for spill response. The third is where coverage of stand-by costs, at least in part, is by the PA, as in Rotterdam, or the city, as in Hamburg.

The costing of services: The research has not revealed how spill response costs are calculated, including the allocation of the costs of long-lived assets. However, ROs have established tariffs which set out the price for particular resources on a time basis.

Policy recommendations

This research is relevant for the port sector as well as for the policy makers. The presented case studies, results and interpretation represent a basic foundation on which decisions with regard to oil spill response planning and management can be made. Policy makers are provided with

an overview of port governance models and empirical evidence with regard to the implication of these models in designating the response agency in spills response. Moreover, the aspect of polluter-pays principle is highlighted as a key element in setting in place strategies to recover the costs of spills. Furthermore, the variety of actors that should be involved in communication on oil spills is relevant for cross-checking. Finally, as oil spill data in port areas is absent, policy makers could contribute in creating a transparent context for managing and publishing this data.

Opportunities for further research

As attention on the environmental performance of shipping increases, in spite of improvements in that performance, it is appropriate for maritime economists to give greater attention to the consequences of governance regimes and the cost recovery methods in oil spill response.

This initial research into aspects of spill response leads to several opportunities for further investigation. Firstly, it would be valuable to examine more fully the business models of ROs, including the contractual relationships that they have with PAs, ships and port businesses and the implications of the models for the incidence of the costs among those paying. Investigation of RO models across ports with different types of shipping could provide insights into the cost drivers in the response industry. Secondly, opportunities also exist for further research by extending the location of spills studied and by widening the span of costs for which the user could be held responsible. For example, special issues arise when spills affect scattered and often remote locations where community enterprises rather than specialized ROs may be the first line of response, as in Alaska. How are local enterprises to be organized and their costs in preparedness and response reimbursed?

The research did not explore the full span of response costs. In theory, disposal costs would be included in the cost recovery but since the means of disposal remains uncertain in many cases (and may drag on for years in some cases) their inclusion in response costs is uncertain. The research did not explore the treatment of prevention costs. Prevention costs might be regarded like policing as a cost to enable an activity leading to wide public benefit. However, as the costs get larger and more specific, this view may be less acceptable.

Finally, there is a case for research by maritime economists into other sources of maritime pollution. For example, case studies would be appropriate on other environmental issues in ports such as plastics, waste, dust, noise or emissions.

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Annex A: Survey design 'Oil spill response and preparedness in ports

The following questions identify specific matters of interest. The questions are grouped into topic areas to facilitate discussion to A. Plans and preparedness, and B. Training, exercises and lessons.

A. Plans and Preparedness

A.1 Response plan.

- Do you have an oil spill response plan?
    - If yes, when was it last updated?
    - Are there regulatory requirements for spill response plans and, if so, are plan contents clearly specified?
    - Is there a process by which plans are reviewed and, if so, by whom?
- What organizational structure does your plan, or emergency response, follow: ICS/UC (Incident Command System/Unified Command) or another?
    - Why was it selected?
- How does your team integrate with other parties in the response processes? If other groups are involved, who is in charge? How is the command structure defined and communicated to all involved?
- Does the plan include a record, list, or maps of environmentally sensitive areas and protection priorities?
- Has a strategy for protecting and cleaning various areas been developed and agreed?
- Do you measure/take into account the public satisfaction of for your oil spill prevention/information/cleaning activity?
- Does your country have a national contingency plan with regards to oil spill response?

A.2 The significance of a spill.

- Who defines the "significance/scale' of a spill? What language is used to define those scales (i.e. level 1, 2, 3; tier 1, 2, 3 other)
    - Has the organization developed defining criteria for these levels of spill?
    - Are there processes in place for assessment of the scale of a spill and of resources (places) most at risk?
- What is your role depending on the 'scale' of a spill?

A.3 Organizational matters

- Have specific emergency responsibilities been identified for the on-site/tactical response?
    - How well would you say people understand their role and responsibility in the event of an emergency?
- Does your plan include pre-approved statements that can be released to "hold" media & others for a short time?
    - How is media communication monitored, particularly online discussions?
    - Is there a prescribed process for review and approval of public releases on incident information?
- Does your plan identify stakeholders within the potentially affected community?
    - Is there a plan in place to monitor/liaise with advocacy groups and the impacted community?
    - Who manages communications/stakeholder engagement?
- How do you plan for the availability of physical and human resources, e.g.:
    - The availability of a command centre.
    - The inventory of spill containment, collection, dispersants, waste handling, shoreline clean-up, and oiled wildlife treatment systems.
    - What are the criteria and process by which the inventory levels are set?
    - What methods are used to ensure the availability of well-informed and connected people (goes beyond training)?

- Have waste storage sites and final disposal plans been identified or prepared?
- Have mutual aid arrangements been made to share response resources within your port, on a national and on an international level? Is response readily scalable?
- How do you deal with community expectations?

A.4 Operational matters.

- Who makes the decision to mobilize emergency response?
- Are time standards defined for the deployment of specific amounts and types of containment and other resources? What process/criteria were used to set the standards?
- Please describe the process/timeline for decisions to mobilize emergency response.
- Incident notification and call-out process – is it direct to the key individuals? How do you/who maintain/s the call out list?
  - How are incident/emergency notifications made? (by phone, pager, SMS/text sent at once?)
  - Is there a specific spill report form used by, or required for, the Port?

A.5 Financial matters

- Do you have a funding mechanism in place that enables you and/or others in the port to respond immediately?
  - If so, how does it work?
- Is there a spending cap or approval mechanism in place and how is that administered? Can cost recovery uncertainty affect spill response? How do you manage this?
- Please tell us about your approach to:
  - Tracking spill response costs (process and practice)
  - To cost recovery (process and time frame)
    - What would happen if the responsible party exceeded the limits of their legal liability?
- Does your organization account for the cost-effectiveness of cleaning operations?

A.6 Your opinions (your views are kept confidential)

- How well do you feel the various areas listed below integrate with one another? Within your organization? Within the spill response community?
  - Emergency/incident notifications
  - Response/activation process
  - Response management both on shore and on site
  - Business continuation
  - Post crisis requirements
    - Root cause analysis
    - cost recovery
    - legal issues/findings
    - incident, response and process improvement
    - debrief with key stakeholders: response organizations, customer and other industry representatives
- How well do you feel your current plan assesses third party risks – i.e. incidents which are not the responsibility of your organization but which have the potential to require response assistance or damage your reputation via implied or implicit relationships?

B. Training, exercises and lessons

- What sorts of training is provided for your team members?
  - Training for on-site/tactical response?
  - Is media training provided?
  - What about training for telephone responders?
- How does your organization pursue effective spill response relationships and collaboration with the other involved parties (terminals, shippers, etc.) for preparedness/planning? Are you confident that all organisations are aware of and can meet their obligations?

- Do you conduct . . . (if yes, how often?)
    - On the water simulations with equipment deployment?
    - Command centre scenario-based training?
    - Inter-agency exercises, national and international? If yes, who is involved?
    - Other?
- Are there established procedures for review and learning from exercises?
- Do you keep a history of oil spills and reports on them? Can you provide data on oil spills reported in the port of Rotterdam over the last five years (date, amount spilled, oil type, etc.)?
- What worked well and what lessons were learned in the case of a recent spill involving your organisation?
- Do you see ways to improve your organization's level of preparedness in case of oil spills? Is research by your organisation or others a part of your improvement strategy?

Annex B. List of Persons Interviewed

Vancouver	Canadian Coast Guard: Tim McCann, Lead, Environmental Response – Western Region Area Response
	Planning (ARP), – Canadian Coast Guard Task Force
	Kinder Morgan: Kelly Malinoski, Manager, Emergency Management.
	Staynor Response Services Ltd.: John Staynor.
	Trans Mountain Expansion Project: Bikramjit Kanjilal, Lead, Marine Development.
	Vancouver Fraser Port Authority: Jeff Pelton, Marine Operations Specialist.
	Western Canada Marine Response Corp: Michael Lowry, Manager Communications.
Houston:	Greater Houston Port Bureau, Captain Bill Dieht, President.
	U.S. Coast Guard: LCR Brent Yezefski, LTJG Keriann Mason, and Chief Tim Rice.
	Port of Houston Authority: Captain William Buck, Chief, Port of Houston Fire Department
	Dr. Joan Mileski: Professor, Texas A&M University at Galveston.
Los Angeles:	U.S. Coast Guard: CDR Rom Mathews; CDR Lushan Hannah; and LCDR Dan Ippilioto.
	State of California: Jon Victoria, Natural Resources Agency, Dept. Fish & Wildlife, Office Spill Prevention
	& Response; Sonya Towers, Environmental Specialist
	Los Angeles County Fire Department: Oliver O'Connel, Rescue Boat Captain
	Port of Los Angeles: Dong Lee, Tactical Planning / Haz-Mat Investigations, Los Angeles Port Police
Seattle:	U.S. Coast Guard: CDR Brian Meier, Response Chief, and LCDR Jason Hagen.
	Port of Seattle: Mike DeSota, Environment Compliance Program Manager.
	City of Seattle, Seattle Fire Department: Willie C Barrington II, Captain, Emergency Preparedness/
	Homeland Security.
Antwerp:	Antwerp Port Authority: Joris Vanderhallen and Kris De Craene.
	Harbour Master: Marc Bosseler, Peter De Pauw, and Robert Hendrikx.
	IBZ (Federal Emergency Planning and Management): Christel Haex and Anne Martens.
	Federal Waterway Police: Peter Van Eeckhoven.
	Civil Protection: Rene D'Hooghe
	Brabo Cleaning Company: Koen De Groof.
	Group de Cloedt (dredging): Jef De Brabandere.
	Antwerp Municipality: Bart Bruelemans.
	Ship Owners' Association: Wilfred Lemmens.
Hamburg:	Ministry of Environment and Energy, Environmental Emergency Response Unit: Dr. Gudrun Winkler.
	Hamburg Port Authority: Sven Maudrich, Head, Support Program Protection
Rotterdam:	Port of Rotterdam Authority: Marco Wensveen.
	Ministry of Public Works: Sjon Huisman.
	AON (Risk Management): Erwin Van Geyte.
	Rotterdam Oilboompool: Oemesh Soekar.
	HEBO Maritime Services: Mark Van de Meer.
U.K., Southampton	Maritime and Coastguard Agency: Will Crocker and Andrew Healy, Counter Pollution and Salvage.
	Associated British Ports Southampton: Ray Blair, Deputy Harbour Master.
	Southampton City Council: Ian Collins, Emergency Planning and Business Continuity Manager and
	Stephanie Layzell, Emergency Planning Officer.
	Adler and Allan Limited: Beth Esau, Marine Contracts Manager and David Bray, Assistant Contract Manager.
	Oil Spill Response Limited: Andrew Nicoll, Advocacy Manager.
U.K., London:	ITOPF Ltd.: Dr. Mark Whittington, Technical team Manager and Nicky Cariglia, Technical Advisor.

Annex C. IMO conventions for environmental protection.

Convention	Year of entry into force	Title	Environment protection (combat maritime pollution)			
			Waste	Oil pollution	Emissions	Dangerous goods
Conventions relating to prevention of pollution						
INTERVENTION	1969	International Convention Relating to Intervention on the High Seas in Cases of Oil Pollution Casualties		✓		
COLREG	1972	Convention on the International Regulations for Preventing Collisions at Sea	✓	✓		
MARPOL	1973	International Convention for the Prevention of Pollution from Ships	✓	✓	✓	
LC	1972	Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter	✓	✓		
OPRC	1990	International Convention on Oil Pollution Preparedness, Response and Co-operation		✓		
OPRC-HNS	2000	Protocol on Preparedness, Response and Co-operation to pollution Incidents by Hazardous and Noxious Substances				✓
AFS	2001	International Convention on the Control of Harmful Anti-fouling Systems on Ships		✓		
BWM	2004	International Convention for the Control and Management of Ships' Ballast Water and Sediments	✓	✓		
The Hong Kong Convention	2009	International Convention for the Safe and Environmentally Sound Recycling of Ships	✓	✓		
Conventions covering liability and compensation						
CLC	1969	International Convention on Civil Liability for Oil Pollution Damage		✓		
NUCLEAR	1971	Convention relating to Civil Liability in the Field of Maritime Carriage of Nuclear Material				✓
LLMC	1976	Convention on Limitation of Liability for Maritime Claims	✓	✓		
SALVAGE	1989	International Convention on Salvage		✓		
FUND	1992	International Convention on the Establishment of an International Fund for Compensation for Oil Pollution Damage		✓		
BUNKER	2001	International Convention on Civil Liability for Bunker Oil Pollution Damage		✓		
The Nairobi International	2007	Nairobi International Convention on the Removal of Wrecks		✓		

Source: Own compilation based on (IMO, 2016b)

ANNEX D: International Convention on Oil Pollution Preparedness, Response and Co-operation: ARTICLE 6

National and regional systems for preparedness and response

(1) Each Party shall establish a national system for responding promptly and effectively to oil pollution incidents. This system shall include as a minimum;

(a) the designation of:

(i) the competent national authority or authorities with responsibility for oil pollution preparedness and response;

(ii) the national operational contact point or points, which shall be responsible for the receipt and transmission of oil pollution reports as referred to in article 4; and

(iii) an authority which is entitled to act on behalf of the State to request assistance or to decide to render the assistance requested;

(b) a national contingency plan for preparedness and response which includes the organizational relationship of the various bodies involved, whether public or private, taking into account guidelines developed by the Organization.

(2) In addition, each Party, within its capabilities either individually or through bilateral or multilateral co-operation and, as appropriate, in co-operation with the oil and shipping industries, port authorities and other relevant entities, shall establish:

(a) a minimum level of pre-positioned oil spilt combating equipment, commensurate with the risk involved, and programmes for its use;

(b) a programme of exercises for oil pollution response organizations and training of relevant personnel;

(c) detailed plans and communication capabilities for responding to an oil pollution incident. Such capabilities should be continuously available; and

(d) a mechanism or arrangement to co-ordinate the response to an oil pollution incident with, if appropriate, the capabilities to mobilize the necessary resources.