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ENVIRONMENTAL RISK OF THE INCREASING OIL TRANSPORTATION IN THE GULF OF FINLAND

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1. Introduction

Maritime transportation has grown substantially in the Baltic Sea during the last decade. Especially strong development has taken place in the Gulf of Finland as Russia and Estonia have built new terminals and rehabilitated their old ones. Probably the most important trend has been the fast increase of oil transportation in the Gulf of Finland due to Russia's investments in the oil port construction on her own territory in order to avoid transit transportation through the Baltic States. The new oil port in Primorsk, that started to operate in December 2001, is the best know example of the recent development. Russia has also other plans to build new oil terminals on the Gulf of Finland, for example in Vysotsk and in Batareinaya. (VTT, 2002b.) Whereas in 1995 about 20 million tonnes (mt) of oil was transported through the Gulf of Finland, in 2000 the figure had more than doubled to over 40 mt, and in 2002 it was already 68 mt. In 2005, the total oil transportation in the Gulf of Finland is expected to reach even 100 mt (SYKE, 2003.)

As the maritime traffic and oil shipping grow in the Gulf of Finland, so does the environmental risk. Statistical analyses expect more than two annual oil accidents during 2001-2005, and three annual accidents during 2005-2010 in the Gulf of Finland (VTT, 2002a). So far, in the Baltic Sea, there has been fewer accidents compared to traffic density than in the world on average (SYKE, 2003). However, the increasing oil transportation together with heavy cross traffic between Helsinki and Tallinn, severe winter conditions like in the winter 2002-03, and recent catastrophic accident of the oil tanker Prestige by the Spanish coast have brought up a question about the safety of oil transportation in the Gulf of Finland.

Being the largest body of brackish water in the world, the Baltic Sea ecosystem is very unique. Unfortunately, the Baltic Sea is also one of the most polluted seas in the world. It is small and shallow and the small water amount with low salinity makes it very vulnerable. The mean depth of the Baltic Sea is only 54 meters whereas for example, the mean depth of the Mediterranean Sea is 2000 meters (WWF, 2003; Furman et al., 1998). The Baltic Sea is connected to the North Sea through the narrow and shallow Danish

Straits. These narrow sounds make the water exchange very slow; the whole water amount takes approximately 25-35 years to be refreshed, thus leaving a long time for pollutants to affect the ecosystem (HELCOM, 2003).

Like other cold seas in the world, the Baltic Sea is especially sensitive to oil pollution. The colder the temperature the slower the oil decomposes. In temperatures below 5 degrees Celsius the biological decomposing is almost non-existent (Leppäkoski, 2003). In addition, the ice cap makes oil combating in the Gulf of Finland more difficult during the winter months. Since there is no natural oil in the Baltic Sea, there are also no bacteria eating oil in its ecosystem as for example is the case in the Barents Sea (Furman et al., 1998).

Oil spills have many ill effects; they contaminate the surface water and smother marine plants and animals. Many chemicals in oil spills are toxic, and they can have serious cumulative effects as they build up in ecosystems. Furthermore, oil spills can have severe repercussions for tourism and fisheries, and the necessary clean-up operations are not only extremely costly but can themselves inevitably harm marine life and coastal habitats (HELCOM, 2003). Especially sensitive to oil spillage is the nature in the Gulf of Finland; its numerous bays and islands hold many times more vulnerable shores than would a straight coastline (Jolma, 2003).

The extent of an oil accident depends always on many factors: the amount of oil leakage, the success of oil combating, the season, the weather conditions etc. Often the magnitude of the accident is determined by the visible acute consequences, such as the shores getting covered with oil, by material loses for example to fishing industry, and by the damage to birds. These consequences can be estimated in monetary value. Pure biological effects, on the other hand, are more difficult to notice (Hirvi, 1987). So far, there is not sufficiently information about the environmental effects of a large oil hazard in the Baltic Sea (SYKE, 2003).

This article concentrates on the environmental risk caused by the increasing oil transportation in the Gulf of Finland. The viewpoint is that of the Finnish experts and authorities. The main focus here is on the risk of oil tanker accidents, but also the important question of illegal oil spills is given some attention. However, the recently acknowledge problem of alien species that is connected to overall increase of maritime transportation, is not discussed in this paper. This article focuses on the risk factors and the possible risk reduction methods that the Finnish authorities consider the most important at the moment. A part of the information for this paper was collected by interviews.

2. Environmental risk and risk assessment

The word 'risk' is generally used in every day talk but there is no commonly accepted definition for the term. In the simplest way, taking a risk means following a course of action, the outcome of which is unclear (Gray, 1986). Usually the noun 'risk' is used to refer to the possible threat of loss or injury or to unpleasant outcomes of an event (Lonka, 2001.) The Oxford English Dictionary (1995) defines the noun risk as "*a chance of danger, injury, loss etc*". The word risk has also a quantitative interpretation as it is sometimes used as a measure for the degree of danger (Raivola & Kamppinen, 1991; Rowe, 1977). Danger is a possible event in the environment that is threatening people or things valuable to people (Raivola & Kamppinen, 1991). Quantitative assessment of risks are used, for instance, in classic gambling games, in business and insurance decisions and in some governmental regulatory actions (Rowe, 1977).

In every verbal description of risk, there are always two central factors: the undesired outcome and the uncertainty of its realisation. The undesired outcome, a damage, describes the losses or harm caused by an occurrence. Uncertainty can be presented as a probability or likelihood. Thus, a risk is a function of the damage and the probability of its occurrence, and it can be presented as a product of the likelihood and the value of consequence in the following way (Lonka, 2001):

$$R = f(P,C) \simeq P * C$$

where

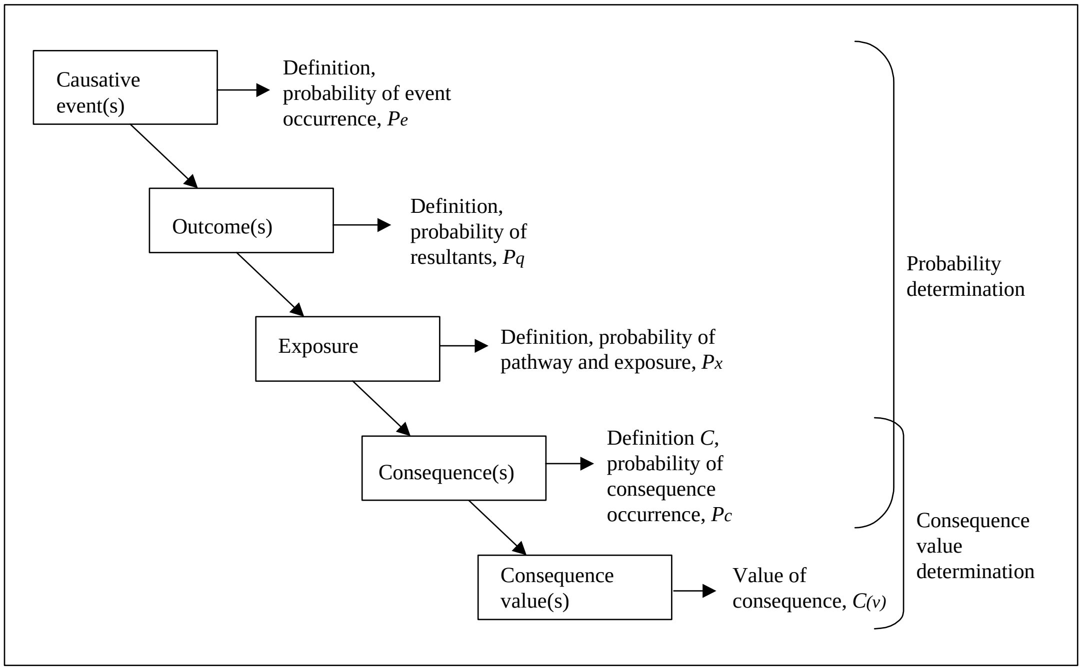
R = risk
P = probability of consequence occurrence
C = value of consequence

'Environmental risk' can be defined as a risk, the consequences of which are environmental damages. The size of environmental damage can consist of one or more harmful effects that are often difficult to measure. The problem is that environmental damage can be very complex and it is difficult to know what consequences should be taken into account in its assessment (Lonka, 2001). For example, chemical injuries can have long-term consequences in the ecosystem, as they may end up assimilated in the food chain. In that way, the time of a spill or release may precede the time for human exposure by many years. Furthermore, the chemical exposures to one generation may result in harm also to their offspring (Katzman, 1988).

It is quite clear that such sudden or unpredictable events causing harm to the environment as oil spills can be classified as environmental risks. On the other hand, environmental risks may include also slow processes threatening the environment, for instance, eutrophication or climate change. Quite often, however, environmental risks are defined to mean only sudden accident type of events (Lonka, 2001). In this paper, the environmental risks of maritime oil transportation are considered to be sudden or gradual releases of oil caused by accidents, malfunctions or illegal oil spills.

Figure 1 illustrates the risk assessment process that shows clearly the binary nature of a risk. As a risk is compounded of both the probability of an occurrence and the quantity of the consequences, it can be reduced by either lessening the probability of the outcome or by reducing the possible consequence. However, in the case of environmental risk, it should be noted that accident prevention is always less expensive than the damage cleaning. In this article, we are not aiming to do a risk analyses but to identify the most important risk factors of oil shipping in the Gulf of Finland, and to consider the ways to reduce the environmental risk.

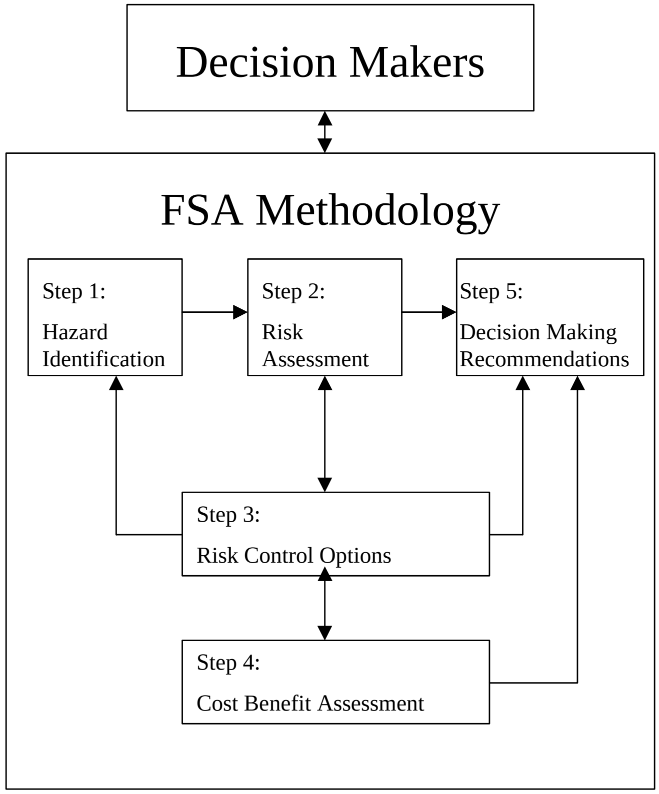
Figure 1. Process of risk estimation



Source: Adapted from Rowe (1977).

Somewhat similar steps as in Figure 1 are included in the Formal Safety Assessment (FSA), a method recommended by the International Maritime Organisation (IMO) for regulatory processes. Unlike the traditional way of rule making that often derives from reaction to a disaster at sea, the FSA-method acts in a pro-active way: it does not put emphasis only on risks which have led to accidents but also on risks that may have severe consequences. FSA is a structured and systematic approach to safety management as illustrated in Figure 2 (VTT, 2002b; IMO, 1997).

Figure 2. Flow chart of the FSA methodology



Source: IMO, 1997.

FSA consists of the following five steps (VTT 2002b):

1. *Identification of hazards.* This steps answers to question "*what can go wrong?*" The result of this phase is a list of all relevant accident scenarios.
2. *Assessment of risks.* This step gives an answer to questions "*how likely is the event?*" and "*what consequences might it have?*"
3. *Generation of risk control options.* Here the question to be answered is "*what can be done in order to prevent the event?*"
4. *Cost benefit assessment of the risk control options*. This step involves giving a monetary value for both the chance of event and the risk control options. Also the effectiveness of different risk control options are evaluated.
5. *Decision making recommendations concerning the options available.* The last step should give an answer to the question "*what should the regulator do?*"

As part of the planning process of the VTMIS-system[1], a limited FSA-analysis was carried out for the Gulf of Finland. However, complete analyses should be made for all oil transportation routes, oil ports and terminals in the Baltic Sea in order to prioritise cost-effectively the essential risk reduction methods and steer the financial resources to the relevant factors in enhancing the safety of maritime transportation (VTT, 2002a).

3. Risk factors of oil transportation in the Gulf of Finland

3.1. Sea traffic density and oil transport volumes in the Gulf of Finland

During the last few years the sea traffic in the Gulf of Finland and in the Baltic Sea in general has not only increased significantly but also the nature of traffic has changed rapidly. Today, many of the shipping routes consist of frequent traffic with fast ships running on a fixed timetable. In the Gulf of Finland, there is also dense passenger traffic for example, between Helsinki and Tallinn. Thus, the biggest risk factor in the Gulf of Finland is considered to be the growing traffic amount and the cross traffic between Helsinki and Tallinn (VTT, 2002a). As the traffic density increases, so does the accident risk, especially for grounding and collisions.

The following table shows the number of all port calls[2] in some of the major harbours on the Gulf of Finland in the year 2000 and estimated figures for the year 2015. The Tallinn port includes the Paldiski South harbour, the Paljassaare harbour, the Old City harbour, and the Muuga harbour. As the investment plans for new ports in Russia have changed very often, this table is not in the line with the latest information about the future development. However, it gives some idea about the increasing amount of port calls in some of the major harbours on the Gulf of Finland.

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1 Vessel Traffic Management and Information Service-system will be implemented in the Gulf of Finland by Finland, Russia and Estonia in July 2004.

2 One port call refers to a ship entering and leaving a harbour.

Table 1. Port calls in the selected ports by the Gulf of Finland in 2000 and 2015

Selected ports on the Gulf of Finland	Port calls in 2000	**Port calls in 2015, estimation**
Hanko (Finland)	980	2 100
Helsinki (Finland)	11 398	15 300
Sköldvik (Finland)	916	1 150
Kotka (Finland)	2 061	2 780
Hamina (Finland)	1 368	1 840
Primorsk (Russia)	0	400
St. Petersburg (Russia)	9 016	13 500
Batareinaya (Russia)	0	200
Ust-Luga (Russia)	96	470
Aseri (Estonia)	0	300
Kunda (Estonia)	600	700
Tallinn (Estonia)	10 383	14 000

Source: VTT, 2002a.

The information of the year 2000 was collected from the harbours themselves and from the Lloyds database. Port calls of passenger ships were calculated based on the timetables. The forecast for the year 2015 was made based on the estimation that the overall transportation in the Gulf of Finland will grow 1,5-fold and oil transport will increase threefold from the level of 2000-2001. However, the port calls are likely not to increase in the same proportion as the transports in general as tanker sizes are expected to grow as well (VTT, 2002a).

Another estimation sets the average number of annual port calls in the Finnish ports in 2015 to 14 500-15 000. A rough estimation of the total annual port call number for the year 2015 in the whole Gulf of Finland area is about 35 000-38 888, presuming that the capacity of the Russian sea ports will increase to 100 mt and Estonian ports to 25-35 mt. On average, this means some 100-120 port calls per day in the Gulf of Finland. However, the traffic is not evenly distributed around the year but on some days the traffic density on the Gulf of Finland may easily exceed 250-300 port calls per day (VTT, 2002b). More recent estimations predict that the total transportation volumes can reach even 190 mt by the year 2010 thus leading to even higher traffic density than estimated before (SYKE, 2003).

In addition to the increase of the total maritime traffic, the tanker traffic is considered to be a special threat. The fast development of Baltic and Russian seaports with the rehabilitation of old ports and construction of new ones has led to a substantial increase of oil transportation, especially in the Gulf of Finland (VTT, 2002b). Table 2 presents the port calls of oil tankers in selected ports on the Gulf of Finland in the year 2000 and estimated figures for the year 2015. Here too, the estimations are based on the expectation that the total oil transportation figures will increase threefold from the level of 2000-2001. As the tanker sizes are expected to grow, the port calls are likely to increase less (VTT, 2002a). The use of bigger tankers decreases the statistical risk of accidents since the risk depends mostly on the amount of port calls. However, bigger tankers mean greater probability of catastrophic accidents in the Gulf of Finland (Interview Jolma, 2003).

Table 2. Port calls of oil tankers in the selected ports by the Gulf of Finland in 2000 and 2015

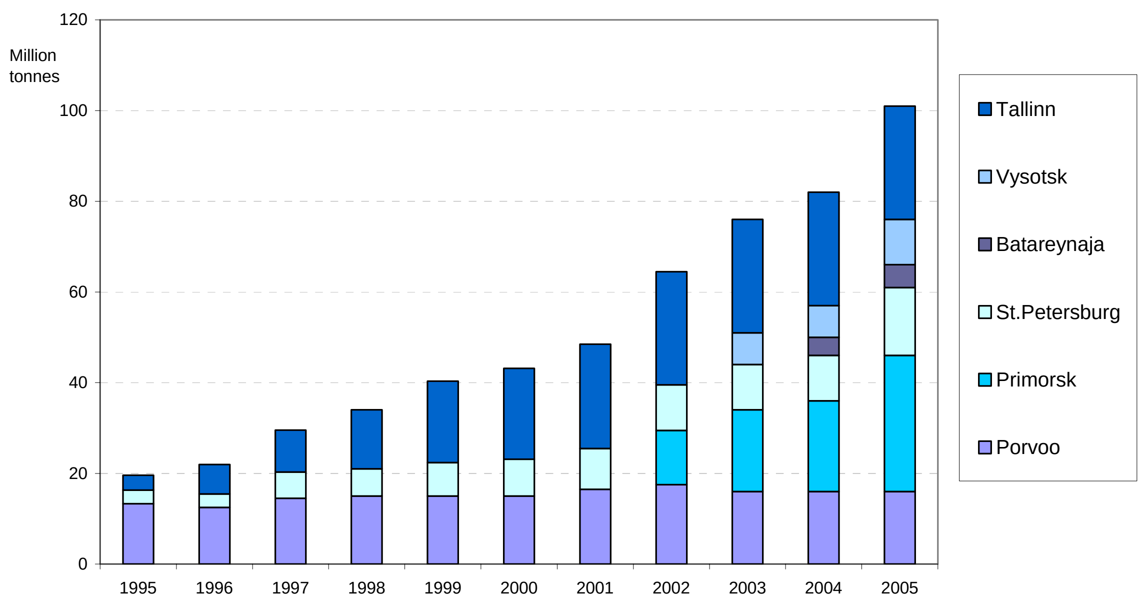
Selected ports on the Gulf of Finland	Port calls of oil tankers in 2000	Port calls of oil tankers in 2015, estimation
Helsinki (Finland)	108	0
Sköldvik (Finland)	916	1 150
Kotka (Finland)	288	370
Hamina (Finland)	276	360
Primorsk (Russia)	0	400
St. Petersburg (Russia)	492	740
Batareinaya (Russia)	0	200
Ust-Luga (Russia)	0	120
Aseri (Estonia)	0	100
Tallinn, Muuga (Estonia)	679	920
Tallinn, Paldiski (Estonia)	0	40

Source: VTT, 2002a.

Although the Muuga terminal was the biggest oil harbour on the Gulf of Finland, in 2000 Sköldvik port had more tanker port calls than Muuga due to smaller tankers (VTT, 2002a). By another estimation, altogether some 6900 port calls of oil tankers will take place in the Gulf of Finland in 2015 (VTT, 2002b). The significant increase of oil transport in the Gulf of Finland is due to the new Russian oil port in Primorsk. The Primorsk oil terminal's first phase was finished in the end of 2001, and in 2002, the port served already 135 tankers (Liuhto, 2003).

The following figure illustrates the increase of oil transportation in the Gulf of Finland in 1995-2002 and provides estimation for the years 2003-2005. As shown in the figure, the oil transportation in the Gulf of Finland had doubled from about 20 mt in 1995 to over 40 mt in 2000, and tripled to over 60 mt by 2002. By the year 2005, the amount is expected to be approximately 100 mt. However, the future estimations change often as Russia announces her new investment plans. For example, only a couple of years ago the estimations of oil transports via the Gulf of Finland for the year 2005 were only about 85 mt annually but now the amount is expected to grow much faster (Interview Jolma, 2003; see also VTT, 2002a).

Figure 3. Oil transportation in the Gulf of Finland through main oil ports in years 1995-2002, and estimated development 2003-2005.



Source: SYKE, 2003.

In 1995-2001, the main ports for oil transportation in the Gulf of Finland were Porvoo (in

Finland), St. Petersburg (in Russia), and Tallinn (in Estonia). Especially the rehabilitated Muuga terminal near Tallinn in Estonia has increased its oil transportation. It is now the major oil transit site for Russian oil in the Baltic Sea, challenging particularly the Ventspils port[3] in Latvia that has traditionally been the most important oil port on the Baltic Sea (Liuhto, 2003). In the year 2002, approximately 25 mt of oil was transported through Tallinn harbour (Jolma, 2003). Also the St. Petersburg port has developed rapidly; the total cargo throughput in 1998 was 15,6 mt, over 20,5 mt in 1999, and over 24 mt in 2000, with about 8 mt of oil products. In 2001 the throughput was stated to be even 36,9 mt of which 9 mt were oil products (VTT, 2002a). In 2002, about 10 mt of oil was transported through the St. Petersburg port (Jolma, 2003).

The biggest increase in the total oil transport in the Gulf of Finland was due to the opening of the Primorsk oil terminal in December 2001. After the first phase, the annual volume of the Primorsk port is 12 mt but it will be expanded to 18 mt as the second pipe will be completed in 2003 (VTT, 2002b). In 2005, some 30 mt of oil is expected to be transported through the Primorsk oil terminal (Jolma, 2003). The final throughput goal was originally set up to 45 mt annually (VTT, 2002a) but some Russian experts estimate the amount to grow up to 70-90 mt by the end of the decade (Liuhto, 2003). Thus, the Primorsk terminal is expected to be the largest Russian oil export terminal in the future (Baidashin, 2003). In the first phase and especially during winter conditions, smaller tankers may be used but the master plan of the terminal uses 100 000-150 000 deadweight tonne (dwt) tankers as design ships (VTT, 2002b).

Besides Primorsk, there are also other investment plans for new oil ports on the Russian territory around the Gulf of Finland. Lukoil’s new terminal in Vysotsk is planned to be opened at the end of 2003, and by the end of 2004 its capacity is to be increased to almost 11-12 mt. When completed the terminal should be capable to handle tankers up to 80 000 dwt. Another new oil port will be opened in Batareinaya by the end of in 2004 with a

3 Ventspils port’s position has been made very difficult by Transneft’s oil embargo.

planned capacity of about 15 mt (Liuhto, 2003). There have been also some plans to use the coal and fertiliser port in Ust-Luga for oil transports as well (VTT, 2002a).

The future amount of oil transportation in the Gulf of Finland depends also on Russia's intentions to build an oil terminal in Murmansk. Finnish authorities hope that the project will be realised and that the main oil flow in the future will go via Murmansk instead of the Baltic Sea ports (Interview Heikkinen, 2003). The reasons for this wish is the environmental concern of the increasing oil shipping in the Gulf of Finland (e.g. Nyberg, 2003). Nevertheless, the Murmansk terminal would have many advantages compared to the Baltic Sea ports: it is ice-free around the year, it has a large capacity (60-120 mt) and it allows tankers of 300 000 dwt to operate. (Liuhto, 2003; EIA, 2002). This would make the crude oil transport route from Murmansk an economically sound solution especially as the oil would not have to be reloaded to bigger tankers for the transatlantic shipping to the USA (Liuhto, 2003; interview Heikkinen, 2003).

It should be noted however, that even if the Murmansk oil terminal is build, the oil transportation through the Gulf of Finland will continue to grow in the future (Interview Heikkinen, 2003). That is why the adequate risk reduction options for the Gulf of Finland should be studied and implemented as soon as possible.

3.2. Tanker fleet and oil accident risk in the Gulf of Finland

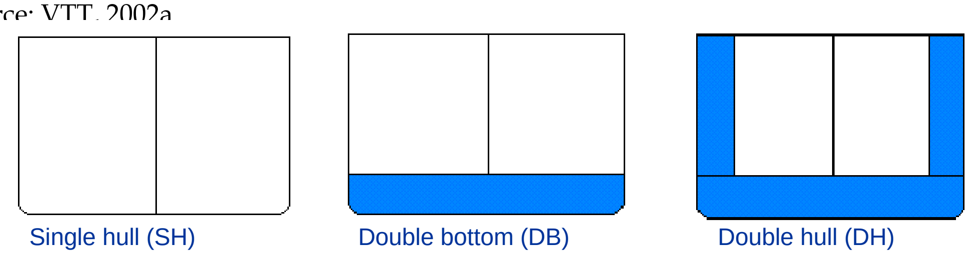
The narrow and shallow Danish Straits set the maximum size of tankers entering the Baltic Sea to about 150 000 dwt. This means that the crude oil from Baltic ports has to be reloaded to larger vessels in some other European harbour for ocean-going transports (Interview Heikkinen, 2003). In the Gulf of Finland, the vessel size for oil transportation has been growing notably. For example, the average tanker size in the Muuga harbour was 19 000 tonnes in 1998, but 41 900 tonnes in 2001. As the crude oil exports increase, the tanker sizes are expected to grow even faster. In Muuga a new pier for two 130 000 dwt tankers has been designed (VTT, 2002a). The amount of large tankers in the Gulf of

Finland will increase heavily especially due to the Primorsk oil port, that is designed for 100 000-150 000 dwt tankers (VTT, 2002b).

The growing tanker sizes in the oil transportation in the Gulf of Finland has a two-sided effect on the environmental risk; on one hand, as bigger tankers are used the amount of port calls will not grow as fast as otherwise, which reduces the statistical risk of accidents. On the other hand, bigger tankers enlarge the maximum possible oil spill, thus, increasing the risk of catastrophic oil accidents. The maximum possible oil leakage in the Gulf of Finland is estimated to be about 30 000 tonnes, which corresponds approximately to the amount of oil in two loaded tanks of a 150 000 dwt vessel. For comparison, the Prestige accident[4] by the Spanish coast is approximately this size. For such a huge oil spill the oil combating resources in the whole Baltic Sea area are highly insufficient (Interview Jolma, 2003).

Generally in the world, oil tankers can be considered fairly safe vessels. According to the accident statistics from 1994, on average of 0,045 accidents happened per an oil tanker in a year. The corresponding figure for all vessel types was 0,044. The most common accidents of oil tankers were 'breakdown and damage' (in 29,5% of cases) and collisions (20,1%). The share of fires and explosions in tanker accidents was 13% whereas in all vessels together it was 8%. The possible oil leakage in the case of an accident depends largely on the tanker structure. The most common tanker structures include single hull (SH), double bottom (DB), and double hull (DH) structures as presented in Figure 3 (VTT, 2002a).

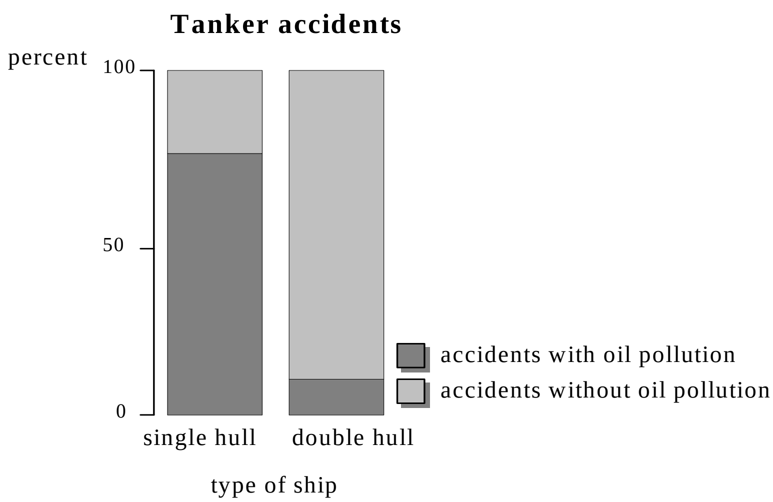
Figure 4. Different tanker structures
Source: VTT, 2002a



In the Baltic Sea roughly one third of the operating tankers are single hull tankers. In some harbours almost all the tankers are double hull vessels and in some others larger than average proportion are still single hull tankers. The scaling of oil pollution fee in Finland keeps the single hull tankers away from Finnish harbours. In Estonia and Russia, however, single hull tankers are still too common, although some progress has happened in the amount of double hull tankers. In May-June 2001, 48% of the tankers visiting both St. Petersburg and Muuga ports had double hulls. In Muuga, 17% were double bottom tankers and 35% single hull. In the St. Petersburg port, double bottom were in 14% of the tankers and 38% were single hull tankers. However, Russia has announced that in her new oil ports, as in Primorsk, all tankers are required to have at least double bottom and on winter time double hull and ice strengthening (VTT, 2002a).

The HELCOM study (1990) indicates that a double hull tanker's outflow risk from the cargo tank is only 1/8 of that of a single hull tanker. Also Figure 4 illustrates, clearly how the accidents of single hull tankers result more often in an oil spill.

Figure 5. Tanker accidents in the Baltic Sea 1989-1999



Source: HELCOM, 2003.

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4 A 26-year old single hull tanker Prestige sank nearby the Spanish coast in November 2002.

The following table shows the increase of the oil spill risk in the Gulf of Finland presuming that 64% of the tankers have double hulls or double bottoms. The forecasts of the table are based on the estimations made in 1999. However, the estimations for the future development have somewhat changed, since the oil transportation has increased faster than estimated at the time.

Table 3. The risk of oil spills in the Gulf of Finland

Time	Oil transportation (million tonnes)	SH tankers' oil spill risk (spills/years)	DH tankers' oil spill risk (spills/years)	Oil tankers, together (spills/years)
1987	15			0,38
1995	22	0,2	0,04	0,24
1997	35	0,43	0,1	0,53
1998-2001	44-54	0,72 - 0,76	0,16 - 0,17	0,88 - 0,93
2001-2005	56-68	0,83 - 0,90	0,18 - 0,20	1,0 - 1,1
2005-2010	70-80	1,04 - 1,12	0,23 - 0,25	1,3 - 1,4
2010-2020	100-110	1,48 - 1,55	0,33 - 0,34	1,8 - 1,9

Source: VTT, 2002a[5].

The table clearly shows how double hull reduces the risk of an oil spill. For example, during a time when oil transportation amount in the Gulf of Finland totals about 70-80 mt, single hull tankers are likely to be involved in an oil leakage every year, whereas double hull tankers would experience it only once in four years (VTT, 2002a).

In Finland, the statistical data of sea traffic accidents has been systematically collected since 1979. However, this information covers only the Finnish territorial waters. Hence, such statistical information is not available on the whole Gulf of Finland area. When estimating the accident risk in the Gulf of Finland, figures of the whole Baltic Sea have been used as a basis (VTT, 2002a). From a statistical point of view, the main reasons for accidents causing oil spill in the Baltic Sea area are grounding and collision. In a study made for Helsinki Commission – Baltic Marine Environment Protection Commission

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[5] Original source: Jolma, Kalervo (1999) *Torjuntavalmius 2005 ja 2010*. Vesivarayksikkö, Finnish Environment Institute. Helsinki.

(HELCOM) by SSPA Maritime Consulting AB in 1998, the composed risk of grounding and collision resulting in an oil spill is estimated to be 0,40 per 1000 journeys. This is an average accident risk for a whole journey. The journey can, however, be divided in different parts with different risk factors, depending on the extent of navigational risk moments. Risks of spill accidents in harbours or during harbour calls were 0,25 per 1000 journeys (SSPA, 1998.). Similarly counting the risk of oil spill in the Gulf of Finland is 0,15 per 1000 port calls (VTT, 2002a). An average spill quantity at a spill accident can be estimated to be 1/48 of the carried oil quantity (SSPA, 1998).

The latest statistical risk analyses for the Gulf of Finland was carried out in 1999 by the Finnish Environment Institute (SYKE). The risk was calculated separately for different routes and harbours (VTT, 2002a; interview Jolma, 2003). The statistical oil damage risk for the whole Gulf of Finland as estimated in that study, is shown in Table 4.

Table 4. **Statistical risk of oil damages in the oil transportation in the Gulf of Finland**

Year	Handled oil amount, (million tonnes)	Accidents per year
1995	20	0,55
1997	30	1,21
1998-2001	max 55	2,0-2,1
2001-2005	max 74	2,3-2,5
2005-2010	max 89	2,9-3,1

Source: VTT, 2002a.

As presented in Table 4, the oil damage risk seems to double as the transported oil quantity doubles. With the current level of oil shipping (68 mt) we could expect even two oil damages per year in the Gulf of Finland. While the oil transportation gets close to 90 mt, the risk is even 3 oil damages per year with an average of 200-300 tonnes of spilled oil (VTT, 2002a). The risk figures here seem quite high compared to actual accident frequencies. Here again the estimations for the amount of oil transported in the Gulf of Finland are lower than in more recent estimations. Unfortunately, at the moment there are no newer studies of statistical risk of oil transportation in the Gulf of Finland. However, new information will soon become available since during the summer 2003 a new statistical risk analyses will be carried out for HELCOM by the Finnish Environment Institute (Interview Jolma, 2003).

3.3. Risk factors in sea traffic and special risks of winter navigation in the Gulf of Finland

Sea traffic risk factors are often divided into three categories: human, external, and technical risk factors. The majority of accidents are caused by human error or negligence of the ship staff whereas the technical reasons are the cause of only one fifth of the accidents (FMA, 2003).

In the risk assessment work carried out for the planning of the VTMIS system, the most relevant risk factors for the Gulf of Finland were pointed out. The lack of professional skills was considered a number one human risk factor. Bad seamanship and negligence of rules resulting from the increasing traffic was a major worry of the experts. Also the possible increase of ships under flag of convenience was considered a risk factor, as the staff of those ships may not have the needed knowledge on the local environment (VTT, 2002a). So far, in the Baltic Sea the seamanship seems to be quite good which is shown by the fact that less accidents compared to the traffic density have taken place in the Baltic Sea than in the world on average. The flag state issue has also been acknowledged by IMO that is working on the suitable instruments for flag state compliance (Interview Heikkinen, 2003; Hoppe, 2000). The large amount of leisure boaters with inadequate navigation skills or insufficient technical equipment was considered another human risk factor in the Gulf of Finland. Bad weather conditions as well as long working hours increase the human risk factor (VTT, 2002a).

External risk factors include the overall increase of traffic density in the Gulf of Finland, and the heavy cross traffic between Helsinki and Tallinn with fast passenger ships and large number of leisure boaters. Increasing traffic density causes danger moments as the traffic flow concentrates in certain points. Furthermore, difficult weather conditions may force vessels out from their normal routes, and confrontations in unexpected places may cause dangerous situations. Harsh weather may also cause structural damages to the vessel. The biggest technical risk factors are connected to the increasing tanker traffic and a possible decline of the technical level of the ships in the Gulf of Finland. The low technical level also is connected to the flag of convenience issue. Especially the large number of single hull tankers still in use is seen as a significant risk factor. Other technical risk factors include fires and explosions on tankers and malfunctions of electronic equipment on board (VTT, 2002a).

A special risk factor in oil shipping in the Gulf of Finland is the winter traffic in ice. The Gulf of Finland is covered by ice on average 3 months a year. The ice cap develops first in the eastern part of the Gulf of Finland, thus, where the Russian ports are located. There the ice lasts on average 120 days per year. The winds push the ice often to the eastern part of the sea, forming ice embankments. Also the mean thickness of the ice grows towards the eastern part of the sea. The mean thickness of plain ice in the eastern part of the Gulf of Finland is on average 50 cm but on harsh winters it can even be 70 cm (VTT, 2002a).

The most common dangerous situations caused by the ice are listed below (VTT, 2002a):

1. The ship gets an ice damage.
2. The ship gets stuck in the pressing ice and gets an ice damage or the ship drifts with the ice and suffers from grounding.
3. The ship is looking for a safer route in ice and gets out from the normal fairway leading to a collision or grounding.
4. Due to ice the ship is unable to skirt another ship and collides with it.
5. Ice accumulates to the upper structures of the ship weakening its stability.

In preventing the most of the above-mentioned dangerous situation the icebreaker assistance is of great importance. In Finland, the nine icebreakers are considered to provide sufficient assistant for vessel traffic even on harsh winters. However, for severe winters icebreaker capacity of Russia and Estonia is insufficient (Tsoi, 2003; Interviews Mylly and Heikkinen, 2003). For example, in the winter 2002-2003 at its peak some 70-100 ships were lying in the ice waiting for icebreaker assistance to the Russian ports (Interview Mylly, 2003). Long waiting periods for the icebreaker help in the pressing ice pose a clear risk to the ship and to the environment. Thus, the winter navigation includes certain risk factors that need to be managed with an adequate winter navigation system.

4. Risk management measures for oil shipping in the Gulf of Finland

From the oil shipping point of you, there are two mutually connected technological systems in the Gulf of Finland: firstly, the navigational system and, secondly, the oil combating system. In this chapter, attention is paid to both of them as they both play major roles in risk reduction measures. In addition, the legal framework and international agreements aiming to enhance maritime safety are discussed here.

4.1. VTMIS–system in the Gulf of Finland

As maritime traffic density together with oil shipping grows, it sets new requirements for the navigational system. The Finnish authorities and experts consider the VTMIS system to be one of the most important concrete risk reduction measures in the Gulf of Finland. VTMIS, or Vessel Traffic Management and Information Service, is an international system already in use in the most frequently visited ports, harbour areas, canals and narrow passages in the world, for example in the English Channel and in the strait of Gibraltar. Finland, Russia, and Estonia have been together developing the VTMIS for the Gulf of Finland. As the monitored area includes also international territorial waters, an approval by the International Maritime Organisation was needed. IMO has accepted the plan but due to Estonia's lack of technical prerequisites, the system implementation had to be postponed. Therefore, the system will be taken into use in the beginning of July 2004 (FMA, 2003).

In principle, the VTMIS-system resembles the system used in air traffic. Vessels entering the Gulf of Finland VTMIS area have to report to the VTS[6] centre in Tallinn, and wait for their permission to use a one-way passage. The westbound traffic reports to Helsinki VTS.

Thus, the vessels must observe the specified traffic separation zones. The traffic is under constant surveillance as the VTS centres also monitor the ships' movements in the fairways, and instruct them in dangerous situations (FMA, 2003).

According to the FSA (Formal Safety Assessment) study carried out by the VTT Technical Research Centre of Finland, the VTMIS reduces the risk of collision by 80%. A positive effect of the system is that it extends the control to the consequences of marine accidents, so that also the volume of oil spills resulting from a collision will be reduced by 80%. In addition, VTMIS system can offer information for other purposes such as search and rescue and the prevention of marine pollution. VTMIS system will also help the winter traffic as it can provide the icebreakers and other vessels with the necessary information for safe and effective navigation in ice (VTT News, 2002).

The positive development in the Gulf of Finland should, however, be extended to the whole Baltic Sea area by improving the co-operation between other Baltic countries' VTS centres (Interview Jolma, 2003). In Finland there has been also suggestions about obligatory escort towing for tankers carrying dangerous cargo, at least between harbours and the open sea. The escort towing would ensure the safety of the ships on passage even under difficult conditions. In the United States, the escort towing is already obligatory but in the Baltic Sea, only Fortum in Finland has introduced escort tugboats (Jolma, 2003).

4.2. Common rules for winter navigation

Another highly important task for enhancing the maritime safety in the Gulf of Finland is the creation of common winter traffic rules by harmonising both the ice classification and winter navigation systems of the surrounding countries. Finland has good experience in the so-called Finnish-Swedish winter navigation system that consists of three elements: icebreaker fleet, ice classification of the ships and traffic regulations and restrictions (VTT,

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[6] Vessel Traffic Service is a system based on a combination of VHF, radar, computers and TV monitoring.

2002a).

By the Finnish-Swedish system vessels are classified by their ice fortification and engine power to the classes I A Super, I A, I B or I C. Ships that are by structure fit for open sea and have steel hulls but lack ice strengthening are classified to class II. Ships outside these classes belong to the class III. As the ice conditions get harder, the traffic restrictions come into force by ruling out the vessels of weaker ice class first. The system guarantees icebreaker assistance only to vessels with an adequate ice class (FMA, 2003). Icebreaker assistance is offered to individual tankers in order to avoid long waiting times. The maximum waiting time to Finnish ports is set to four hours. The Finnish icebreaker fleet of nine vessels is considered to be sufficient even on harsh winters (VTT, 2002a). During the winter 2002-2003, the system worked satisfactorily although the target maximum waiting times were sometimes exceeded (Interview Mylly, 2003).

Russian ships are usually classified by Russian classification societies and Estonia follows the classification of authorised international classification societies. The classification systems of different societies are, however, completely comparable. Thus, the differences are very small and the classification leads to more or less same outcome (Interviews Mylly and Heikkinen, 2003.)

However, some differences can be found between the Finnish and Russian winter navigation systems. Whereas Finland offers icebreaker assistance to individual ships, Russia appoints the ships a waiting place, from where several ships gathered together will be assisted to the harbour. Naturally, this system requires fewer icebreakers but leads to longer waiting times (VTT, 2002a). Especially on severe winters the waiting times are stretched long since the Russian icebreaker capacity is insufficient. And as the tanker sizes has grown, the need for icebreakers has become even greater, since two icebreakers are needed for making a wide enough waterway for the big tankers. Also Estonia's icebreaker capacity is deficient. In fact, Estonia has only one own icebreaker at the moment. The lacking capacity is covered by renting icebreakers from neighbouring countries (Interview

Mylly, 2003).

Differences between the Finnish and Russian systems can also be found in practical implementation. Instead of introducing strict restriction based on the ice class, Russian officials have chosen to ensure the oil transportation by grating special permission to some vessels (Interview Mylly, 2003). For example, on winter 2002-2003 two oil tankers, Stemnitsa and Minerva Nounou, gained large publicity in the Finnish media while transporting oil from the Primorsk port. The tankers lacking the adequate ice fortification were considered an environmental threat by the Finnish authorities (e.g. Helsingin Sanomat 29.1.2003, 1.2.2003 etc.). However, in Russia they were viewed to be safe enough with icebreaker assistance, and were given a Russian ice pass (Tauru, 2003; Tsoi, 2003).

The question of the common winter navigation rules was discussed in HELCOM meeting in Copenhagen in 2001 but no resolution was made. Finland has renewed her initiative and the matter will be discussed again in the HELCOM ministerial meeting in June 2003. According to the Finnish Maritime Administration, the Finnish-Swedish winter navigation system would be a good basis for developing the common system for the whole Baltic Sea area. Harmonisation of the winter navigation rules and implementing a common system for winter traffic is viewed to be the best way to enhance the safety of shipping in ice (Interviews Mylly, Jolma, and Heikkinen, 2003).

4.3. Phase-out of single hull tankers

Recent accidents of the oil tankers Erika[7] and Prestige have brought up the question of safety of single hull tankers. After the Erika accident IMO adopted a revised phase-out schedule for single hull tankers that gives the year 2015 as a principle cut-off date for all single hull tankers. Single hull tankers are phased out starting from 2003 by ruling out the

[7] The 24-year old oil tanker Erika split in two off the French Atlantic coast in severe weather on December 12, 1999, and spilled 15 000 tonnes of her heavy fuel oil cargo.

oldest and structurally weakest tankers first. Thus, Category 1 tankers[8], such as Erika and Prestige, will be ruled out by the year 2007 (IMO, 2003).

In the European Union, the IMO schedule is considered to be too slow. Thus, the EU is going to accelerate the phase-out of single hull tankers and within the Union all single hull tankers will be ruled out gradually between the years 2003 and 2010. Erika and Prestige type of tankers are phased-out by the year 2005. Thus, in principle, no single hull tankers will be allowed in European Union harbours after the year 2010 (Interview Heikkinen, 2003).

In the Baltic Sea area, approximately a third of the operating oil tankers have only single hull. In Finland, practically all tankers are however double hull tankers. In Russia, the ports have their own regulations, and for example all tankers visiting the Primorsk port are required to have at least double bottoms, and on winter time double hulls. At the moment in the Gulf of Finland, the situation is probably the worst in the Muuga terminal in Estonia, where still over 30% of the oil transportation is handled by single hull tankers (Interview Mylly, 2003).

As Estonia will become a member of the EU in 2004, she has to follow the accelerated phase-out schedule. Single hull tankers may however operate in the Gulf of Finland until 2015, as Russia has no obligation to follow to faster phase-out timetable of the single hull tankers. Nonetheless, the EU's decision will probably reduce the number of single hull tankers in Russian ports as well, since most crude oil is shipped to European harbours, for at least reloading to bigger tankers. Refined oil products, however, are usually transported with smaller vessels and may thus continue straight to countries outside the EU (Interview Heikkinen, 2003).

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[8] Category 1 means oil tankers of 20 000 dwt and above carrying crude oil, fuel oil, heavy diesel oil or lubricating oil as cargo, and of 30 000 dwt and above carrying other oils, which do not comply with the requirements for protectively located segregated ballast tanks (IMO, 2003).

As the risk of oil spill is remarkably greater with single hull than double hull tankers, Finnish authorities naturally hope that Russia chooses to follow the faster phase-out schedule together with the EU. Furthermore, the European Union countries are trying to influence IMO so that the similar accelerated schedule for the phase-out of single hull tankers as in the EU would be implemented by IMO as well (Interview Heikkinen, 2003). However, it does not seem very likely that IMO will accelerate the schedule since it is not in the interests of the shipping industry (Interview Mylly, 2003).

4.4. Prevention of illegal oil discharges

The majority of the oil pollution in the Baltic Sea is resulting from illegal oil discharges. Annually some 500-700 illegal oil discharges are observed by aerial surveillance flights in the Baltic Sea but the actual figures are estimated to be much higher (HELCOM, 2001a). Altogether in the Baltic Sea, even several thousands illegal oil discharges are estimated to take place every year (Interviews Heikkinen and Jolma, 2003). If each of them is even one cubic metre in amount, the total annual oil quantity entering the sea from illegal discharges is more or less equivalent to the amount of oil spilled in the accident of the oil tanker Erika (Interview Jolma, 2003). As the oil tanker traffic increases, the amount of illegal oil discharges is suspected to grow too.

Already under Annex I of the MARPOL 73/78 -convention[9] the Baltic Sea was designated as a Special Area and thus, oil discharges with oil content bigger than 15 parts per million (ppm) have been forbidden in the Baltic Sea area since the contract became effective in 1983. The ports by the Baltic Sea have been obliged to provide port reception facilities to meet the needs of the ships using them without causing undue delay. Thus, all ports are required to have adequate facilities to receive dirty ballast water and tank washings from

9 The International Convention for the Prevention of Marine Pollution from Ships, 1973 as modified by the Protocol of 1978 (MARPOL 73/78) entered into force on 2 October 1983.

oil tankers, and other oil residues and oily mixtures from all vessels (HELCOM, 2001a).

To ensure the implementation of the oil discharge regulations, a Strategy for Port Reception Facilities for Ship-generated Wastes and Associated Issues (the Baltic Strategy) was adopted in 1996 by the Helsinki Commission. In HELCOM recommendations following the Baltic Strategy, ships are obliged to deliver all ship-generated wastes and cargo residues before leaving the port. In order to create incentive to deliver wastes to reception facilities rather than discharge them illegally into the sea, a 'no-special-fee'-system has to be used in all the ports. According to that system, a fee will be levied on a ship regardless of the actual waste delivery (HELCOM, 2001a).

Despite of the international and HELCOM regulations, illegal discharges of oil have been too common in the Baltic Sea. The problem gained large publicity in Finland again in the spring 2003, when a large oil spill was discovered in the Gulf of Finland. Several tonnes of oil were collected from the sea by Finnish authorities. The oil is believed to have been discharged by several tankers waiting to get to the Primorsk port during the winter, when illegal effluent is harder to notice due to the ice cap (Liuhto, 2003). HELCOM (2001) has listed some future actions to be considered in order to prevent the illegal oil spills. This includes, among other things, extending the EUROCRUDE database to contain fingerprints of crude oil and oils transported in the Baltic Sea, which would thus, enhance the possibility to identify the ships committed the illegal oil discharges.

Also the Finnish authorities are thinking of possible ways to prevent the malpractice. The creation of the Finnish economic zone[10] could help the situation, as it would allow Finland to intervene also in the illegal oil discharges committed outside the Finnish territorial waters. Also the introduction of the so-called German model with on the spot fines and the burden of proof on the shipping companies has been discusses by Finnish authorities. However, its suitability to the Finnish legislation has to be decided by the

Ministry of Justice (Interviews Salminen and Heikkinen, 2003). Certainly, the most important factor in the prevention of illegal oil discharges is the elimination of the reasons for them (Interview Jolma, 2003). Thus, the HELCOM strategy should be followed more carefully, by making sure that all the ports do follow the 'no-special-fee'-system and have adequate facilities for oil waste reception available without undue delays.

4.5. Oil combating capacity in the Gulf of Finland

A big oil disaster is the most frightening scenario for the Gulf of Finland environment. Thus, no matter how good intentions there are to improve the safety of oil shipping and to prevent accidents in advance, the preparedness for oil combating should be the utmost priority of all the coastal states in the Gulf of Finland. As the oil transportation amounts grow, so does the risk of oil spills. And as the tanker size grows, so does the maximum possible oil spill quantity.

In the Gulf of Finland, there has been no over 1000 tonne oil spills larger, although in the world they are not uncommon. Basically, there is enough capacity for combating such oil spills in the Gulf of Finland, but the results of oil combating depends always on prevailing conditions and on how fast the combating vessels reach the accident site. On bad weather and on ice conditions, the amount of recovered oil stays usually low. For oil spills over 10 000 tonnes, even the capacity of all the Baltic Sea rim states is not enough, and the help would not even arrive in time (Jolma, 2003). As the worst possible scenario of an oil leakage in the Gulf of Finland is as much as 30 000 tonnes, the need for improving the oil combating capacity in all Baltic Sea countries is prominent (Interview Jolma, 2003).

In Finland oil combating is the responsibility of the Finnish Environment Institute, who leads the oil combating operations, and is responsible for the oil combating preparedness.

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10 Economic zone is the water area that the state can announce outside of its territorial waters. The state is able to prosecute for the crimes committed in its economic zone.

When needed, also the Finnish Boarder Guard, Defence Forces, and Maritime Administration take part to the operations by giving personnel and oil combating technology and vessels for assistance. All together, Finland has 11 oil-combating vessels from which two belong to the Finnish Navy, one to the coastguard and eight to the Finnish Maritime Administration (SYKE, 2003).

Oil combating preparedness is connected to international agreements on oil combating co-operation. Finland is a contract partner in Helsinki Convention[11] about the Baltic Sea protection and in Copenhagen Agreement between the Nordic Countries, and has bilateral agreements with both Estonia and Russia. Also in the EU, there are similar agreements on co-operation between the member states. In addition, Finland is among the contracting states in International Convention on Oil Pollution Preparedness, Response and Co-operation (SYKE, 2003).

The most central of these agreements with the furthest reaching regulations is the Helsinki Convention, which states that all the contracting states should have adequate combating resources for oil and chemical accidents for reaching any accident site inside the country's territory within six hours. The states should also have enough capacity to recover all the oil floating in the water within two days time (Lonka, 1998).

Nevertheless, the ability for oil recovery is not the only measure in oil combating. The HELCOM ministerial meeting in Copenhagen in 2001 decided that all the countries should have adequate capacity for emergency towing, fire fighting and emergence lightening (HELCOM, 2001b). This capacity is lacking in all the surrounding countries of the Gulf of Finland. For example, Finland does not have an oil recovery vessel in the eastern part of the Gulf of Finland. Also the ability to collect oil in ice is lacking.

[11] The present contracting countries to HELCOM are Denmark, Estonia, Finland, Germany, Latvia, Lithuania, Poland, Russia, and Sweden.

Furthermore, Finland has capacity for emergency towing and fire fighting only in the winter when the icebreakers are operating, and sufficient lightening capacity is available only in tankers operating in the area (Interview Jolma, 2003).

The situation in Finland will somewhat improve in 2003 as the Finnish Maritime Administration's rather big vessels, such as Seili, are renovated and equipped with oil collection system suitable for ice conditions. After that all nine fairway-maintenance vessels of the Finnish Maritime Administration will be equipped with oil combating equipment (Interview Mylly, 2003). However, this does not improve the insufficient capacity in chemical combating, in emergency towing or in fire fighting. In addition, a large multifunction vessel capable in operating in ice is needed as well. This need is also recorded in the Governmental Platform of Finland (Jolma, 2003; interview Jolma, 2003).

Also Russia and Estonia are lacking the emergency capacity and they both need a seagoing vessel with modern oil and chemical combating technology. In Russia, the Primorsk oil terminal has adequate oil combating capacity but in the open sea the state authorities are responsible for oil combating. Russia is acquiring new oil combating capacity, but the acquisition of a desperately needed modern oil recovery vessel is still uncertain (Jolma, 2003). However, Finland, Russia, and Estonia have recently negotiated about a possibility to acquire three new vessels suitable for icebreaking and oil-combating operations in the Gulf of Finland. The idea behind the negotiations is that the three countries could join hands for oil combating. The European Union is hoped to give some financing for the project that, if realised, would improve significantly the preparedness of oil combating in the Gulf of Finland (Turkki, 2003).

Thus, the biggest needs in oil combating resources in the coastal states of the Gulf of Finland are connected to technical equipment, new vessels and new methods of oil recovery especially in ice. On the other hand, co-operation between the coastal counties is functioning well with joint exercises, shared information and assistance in real accident situations (Interview Jolma, 2003).

5. Summary

The oil transportation in the Gulf of Finland has increased tremendously during the last few years. The development is mostly due to the new oil ports in Russia and the rehabilitation of old oil ports both in Russia and in Estonia. Whereas the oil shipping in the Gulf of Finland was about 20 mt in 1995, in 2002 the amount had more than tripled to 68 mt. In 2005, the total oil transportation in the Gulf of Finland is estimated to reach 100 mt.

The increasing oil shipping together with growing cross traffic is considered to be a significant risk to the vulnerable maritime environment in the Gulf of Finland. With the current oil transportation volumes we can expect more than two annual oil accidents in the Gulf of Finland, and soon the figure may be even three. Especially the possibility of a catastrophic oil disaster is increasing as larger oil tankers are operating in the Gulf of Finland. So far there has not been any big accident with over 1000 tonnes of oil spilled in the Gulf of Finland area. However, the maximum possible oil spill is estimated to be even 30 000 tonnes, for which the oil combating capacity in the whole Baltic Sea area is completely insufficient. Table 5 summarises the risk factors and risk reduction methods the Finnish authorities consider the most relevant at the moment.

Table 5. Summary of risk factors of oil shipping in the Gulf of Finland and the most relevant risk reduction methods

Risk factors	Risk reduction methods	Timetable
- Increasing traffic density - Growing oil transportation - Risks of winter navigation	-VTMIS –system	- Will start operating on July 1, 2004.
	- Common winter navigation – system (ice classification and traffic restriction rules)	- Discussed in HELCOM ministerial meeting in June 2003. No decisions made so far[12]
- Single hull tankers	- Prohibition of single hull tankers' operations in the Baltic Sea.	- The phase-out of single hull tankers will take place in EU during 2003-2010, and by

[12] At the time of writing the article, the HELCOM ministerial meeting had not taken place and thus, a possible resolution was not known.

		IMO schedule till the year 2015.
- Illegal oil discharges	- Stricter compliance with the Baltic Strategy in the ports (waste reception facilities, no-special-fee –system) - Stricter punishments (on-the-spot fines, the German model)	- Finnish authorities are only considering the best possible tools for solving the problem
- Insufficient oil combating capacity in all surrounding countries.	- Acquisition of new oil-combating vessels and other technology in all surrounding countries.	- Uncertain. However, Finland, Russian and Estonia have discussed about acquiring three new oil-combating vessels for the Gulf of Finland.

The precaution methods for risk reduction of oil damages all require co-operation between the coastal countries of the Gulf of Finland. The Finnish authorities consider the implementation of the VTMIS-system to be one of the most important ways to enhance the safety of maritime transportation. The system is developed together with Finland, Russia and Estonia, and it will be taken into use in July 2004. According to the Formal Safety Assessment made as part of the planning process of VTMIS, the system is estimated to diminish the risk of collisions and grounding for even 80%.

Another necessary measure for risk reduction according to the Finnish authorities is the development of common winter navigation rules with a common ice classification and traffic restriction system. Furthermore, Estonia and Russia need to improve their icebreaker capacity that is insufficient at least on severe winters. The issue of common winter navigation system will be discussed in HELCOM ministerial meeting on summer 2003 and hopefully also a resolution will be achieved then.

As the risk of oil spill is significantly higher in single hull than in double hull tankers, Finnish authorities hope that prohibition of single hull tankers in the Gulf of Finland takes place as soon as possible. In the EU, the single hull tankers will be ruled out gradually by the end of 2010. The new Russian oil ports have own regulations and mainly accept only double hull tankers. Otherwise, Russia is only obliged to follow the phase-out schedule of

IMO that is five years slower than the EU's timetable. In the Gulf of Finland, the situation is probably the most unsatisfactory in the Muuga terminal in Estonia, where still more than 30% of the tankers are single hull vessels. However, as Estonia will join the EU in 2004, she will have to follow the faster schedule for phase-out of single hull tankers.

Co-operation is also needed in order to bring the illegal oil discharges to an end in the Baltic Sea. Altogether the annual oil amount illegally discharged into the sea equals that of a major oil accident. However, a major oil accident is viewed as a worst risk scenario in the Gulf of Finland, because the ability to reach the accident site in time with sufficient oil combating capacity to prevent the oil from spreading and reaching the shores is highly insufficient in the area. Thus, the improvement of oil combating capacity in all the coastal states of the Gulf of Finland is greatly needed. According to HELCOM recommendations, the Baltic Sea states are required to have sufficient oil recovery, emergency towing, fire fighting, and emergency lightening capacity. However, all the surrounding states of the Gulf of Finland are lacking the above mentioned capacities. Thus, the environmental risk of oil transportation and the possibility of a major oil disaster in the Gulf of Finland are greater than ever before.

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