Finnish experience in oil spill prevention and response in the Baltic Sea

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1 Introduction

The increase in marine traffic in the Baltic Sea in the last decade changed the need of preparedness for a major oil spill accident in this region. The growing amounts of oil transportation and the use of larger tankers have also elevated the risk of oil spills in the Baltic region. The European Union has recently approved its Baltic Sea Strategy, which outlines a comprehensive strategy for the economic development and environmental protection of the Baltic Sea area. The aim is to improve the economy in a sustainable way, while improving the environment (EUSBSR, 2010). Under the Convention on the Protection of the Marine En¬vironment of the Baltic Sea Area (HELCOM 1974), Baltic coastal states are committed to cooperate effectively in response to any oil spills by collecting the oil with vessels specially equipped for this purpose. Decisions taken by the Helsinki Commission are regarded as recommendations to the governments concerned (HELCOM Baltic Sea Action Plan, 2007).

In Finland the Finnish Environment Institute (SYKE), together with other pollution response authorities, have to maintain and enhance their preparedness and have to be prepared to respond to any pollution incident. Water pollution in the Baltic Sea is a sensitive topic that has been studied by many scholars over the last 30 years. The Baltic Sea is a vulnerable sea area due to its characteristics such as the low salinity of waters, fractal coastline climate conditions, closed in-land sea with slow water exchange and icy conditions for six months during the year. Because of this, oil pollution is likely to have a harmful impact on the unique and vulnerable ecosystem of the Baltic Sea. The existing organisms provide the ecosystem with its safeguarding ability and the loss of just one vitally important species may in effect cause the whole ecosystem to change. Furthermore, since the coastline of the Baltic Sea is fragmented, in case of a large-scale oil spill, hundreds of kilometers of coastline may be polluted unless the spilled oil is recovered in the open sea and will not reach the shore (Rousi, 2012).

Finnish studies have shown that due to the vulnerability of the Baltic Sea area, it is important to develop requirements and to create special equipment, which would help reduce these harmfull influence on the Baltic Sea water environment. SYKE has completed many studies about the Baltic Sea waters in case of an oil spill occurance for both ice covered and open sea water conditions.

2 Objectives of the study

This study focuses on the current state of knowledge, technologies and experience in responding to oil spills accidents in open sea and in icy conditions, which has been accumulated in Finland during the last 30 years. The research has three objectives: 1) To study the Baltic Sea Environmental Institutions and organisation structure, 2) To evaluate current Finnish developments and technologies in area of oil spill prevention, detection, response methods and recovery technologies, particularly in ice, and 3) To assess the preparedness level of Finland by

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studying the latest changes in communication and actions coordination between the Finnish authorities and the Baltic Sea countries in the state of an oil spill accident occurrence in the Baltic Sea region.

3 Oil spill prevention and response in Finland

3.1 SYKE and HELCOM

The environmental pollution protection infrastructure has been developed in Finland over the years and it is well organised. The Finnish Environment Institute, SYKE, operating under the Ministry of the Environment, is the proficient authority dealing with marine pollution. SYKE is also responsible for the purchase and development of governmental oil spill cleanup equipment, including oil spill response vessels. SYKE works in cooperation with other organisations presented in Figure 1 (SYKE, 2012).

In case of an oil spill accident, a response commander (RC) is appointed by SYKE to lead the response activities. Special units, like the Navy, FBG, TraFi and others can be called by the RC to assist if required. At the local level RC appoints a Supreme On-Scene Commander (SOSC). Also at the local level individual Rescue Service Regions (RSR) are required to maintain a response capability for their area of responsibility. ELY advise and supervise local authorizes and companies in arranging pollution preparedness. Volunteers can be asked to assist in contaminated bird cleaning as well as in shore cleaning.

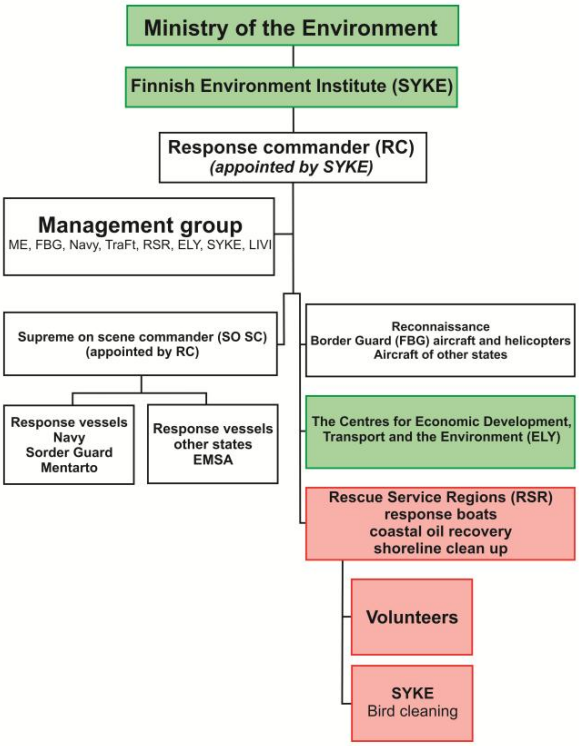

Figure 1 *Finnish environmental pollution protection infrastructure. Figure provided by SYKE.*

HELCOM is the oldest and most respected organisation working in the Baltic Sea area. It is the governing body of the "Convention on the Protection of the Marine Environment of the Baltic Sea Area," commonly known as the Helsinki Convention of 1974 and 1992, the first regional convention to address the Baltic Sea. HELCOM works not only as an environmental policy-maker for issues related to the Baltic Sea, but also as the main organisation which co-ordinates and supervises the implementation by the Contracting Parties. In addition to that, HELCOM provides information about the environmental status and trends in the Baltic Sea area, the measures and their efficiency. HELCOM's members are all the nine Baltic coastal nations: Denmark, Estonia, Finland, Germany, Latvia, Lithuania, Poland, Russia and Sweden, as well as the EU.

3.2 Illegal Oil Discharges

The main reason that allowed to control and to reduce the number illegal oil discharges in Finland was a new law, which entered into force in 2006. This law enabled faster imposition of administrative oil pollution fees than the normal criminal procedure on shipping companies or private individuals found guilty of oil spill offences. The amount of the fee depends on the volume of the spill and the size of the vessel. In 2012, the Finnish Border Guard investigated only two oil spill incidents, which is eleven cases less than in 2007. The amount of a single oil pollution fee has been approximately 10,000 euros over the last six years and it seems that the fee has acted as a deterrent in Finland.

Effective aircraft surveillance, which has been carried out in cooperation with the neighboring countries of Finland, has played a key role in reducing the number of oil spills. Regular surveillance flights have been carried out since the 1980s with an aircraft equipped with environmental monitoring systems. Finland purchased its surveillance aircraft in the mid-1990s. Despite the decline in spills, much remains to be done as the Baltic Marine Environment Protection Commission (HELCOM, 2010) seeks to put a stop to oil spills in the Baltic Sea by 2021.

3.3 Oil Spill Detection in ice

The difficulties in detecting oil in or under ice are numerous. Ice is never a homogeneous material; on the contrary, it includes air, sediment, salt, and water, many of which may present false oil-in-ice signals to detection mechanisms. In addition, snow on top of the ice, or even incorporated into the ice, adds complications. During freeze-up and thaw in the spring, there may not be distinct layers of water and ice. There are many types of ice and different ice crystalline orientations. Over the years the numbers of technologies for detecting oil in or under ice have been developed in Norway, Finland, Canada and US, but the technologies are still evolving. The state-of-the-art technology for the detection of oil on ice is more advanced than that for oil under ice. To detect oil mixed with ice optical technologies may work with some limitations. (Lampela, 2011).

Laser fluorosensors show the greatest potential for detection of oil when the oil is exposed to the surface. The fluorosensors are also the only reliable means of detecting oil in certain ice and snow situations. There are also new technologies like acoustic, radar based (Ground Penetrating Radar) and electronic gas sensors, ''sniffers''. Some of these methods have shown potential to track oil also under ice and snow, but they still need further development and

testing. Trained dogs are also able to reliably detect very small volumes of oil and to map oil boundaries on solid ice and in sediments on Arctic shorelines under cold conditions (Lampela, 2012).

3.4 Oil Spill Response methods

Due to the fragile and sensitive ecology of the Baltic Sea, it has been agreed in the Helsinki Convention that the oil combatting policy of the Baltic Sea countries must be based on mechanical combatting and recovery of oil (HELCOM Baltic Sea Action Plan, 2007). The agreement also restricts (HELCOM Recommendation 22/2) the use of chemicals – so called dispersants – which lower the surface tension at the oil-water interface and dissolve the oil slick into tiny droplets that are diluted into the sea water. Because of these agreements dispersants are not used in Finland. In Finland all oil recovery vessels are government-owned and they are capable of independent oil recovery, i.e. they are permanently fitted with built-in oil recovery systems (SYKE, 2012).

The national oil spill response authority, the Finnish Environment Institute (SYKE), has worked together with private companies and research institutes for over 20 years, both in Finland and abroad, to develop mechanical recovery methods to handle oil in icy conditions (Lampela, 2011). The developed methods and techniques are based mainly on brush technology. Several devices have been developed and then tested on laboratory scale and in real-world conditions over the years. There are two specific technologies, which have been developed for oil recovery on ice:

1. The LORI Ice Cleaner (Figure 2), designed and manufactured by LORI Company. A specialized skimmer bow, is designed to operate in broken ice at sea, lakes, rivers and ports. Its recovery process is carried out by a two-stages brushing and water pumping system. At first, high pressure water jets loosen oil from ice blocks and the robust brush chains under the bow completes the cleaning of the ice blocks. Then loose oil is separated from water with conventional oil-collecting brush chains. After two prototypes and field testing operational equipment is now owned by the Finnish Environment Institute (Lampela Kari, 2011).

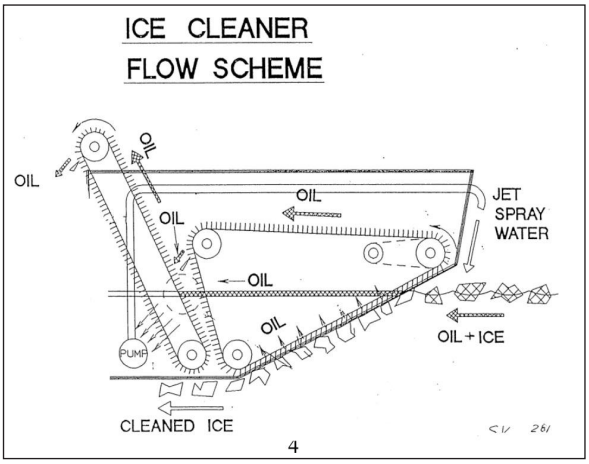

Figure 2 *LORI ice cleaner. Figure provided by SYKE.*

2. The LOIS system (Figure 3) invented by SYKE and designed and manufactured by Lamor Corporation Ab, consists of removable oil in ice separator units, which can be installed on an oil recovery vessel with special fittings when needed. The idea of this specialized ice skimmer is to use a vibrating grid connected to sides of a response vessel to force the ice blocks submerged under the recovery unit to move upside down when the vessel is going forward, and possible rotate ice by moving the grid. By increasing the relative movement between the oil-covered ice blocks and water spilled oil is washed out of the ice blocks. Oil rises through the grates to water surface, which is inside the body of the LOIS. The oily water is then pumped through a conventional brush chain system in the companion response vessel, where the oil is then separated from the water. Any small pieces of ice, which enter the brush system, are transferred back to sea by conveyor (Lamor Corporation Report, 2012).

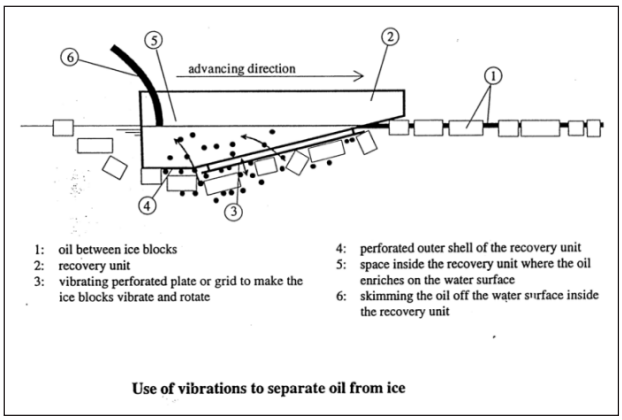

Figure 3 *The LOIS system. Figure provided by SYKE.*

3.5 Preparedness level of Finland

Finland is reasonably well prepared for oil spills on the open sea, but there are still limitations in the coastal regions and in icy conditions. Some major investments, which address these deficiencies, must be made in the near future. The following actions are taken in Finland (SYKE 2012):

1) *Monitoring marine traffic in and evaluating risks of vessel accidents*:
Finland is using also EMSA's CleanSeaNet satellite based monitoring service to detect oil pollution at the Baltic Sea.

2) *Improving disaster response capacity and technology for both icy and open sea conditions*:
Finland has the best and efficient fleet of oil and chemical spill response multipurpose vessels on the Baltic Sea. They are capable of taking part in environmental protection tasks besides their everyday duties, such as coastguard work, service assignments and shipping lane construction (SYKE, 2012).

3) *Developing new technologies for combatting oil spills in both icy and open sea conditions*:
SYKE is also responsible for purchasing and developing new oil combating equipment.

4) *Testing readiness to respond in case of oil spills*:

The BALEX DELTA operational response exercises in cooperation with other Baltic Sea States have been held annually since 1989. The 2012 Balex Delta exercise was organized by SYKE, Finland.

4 Relevance of the research

Currently, a lot of attention is paid to the transportation of oil in Barents Sea region. Even more attention has been given to the Northern Sea Route which is considered to become the next shipping lane for oil transportation. Gains from shipping through the Northern Sea Route between Europe and Asia will be the reduced number of days at sea. Other gains besides the speed are fuel efficiency of the vessels in this route compared to more southern shipping lanes and other economic benefits.

At the same time as traffic is expected to increase in the Northern Sea Route, there are numerous environmental issues and challenges, which have to be addressed. More ships in the Northern Sea Route and in the Barents Sea sets great demands for oil spill accident response in icy conditions. In case of an oil spill the bordering countries should be well prepared to react immediately. Increased knowledge about environmental benefits and costs for both the Northern Sea Route and Barents Sea region are very essential in order to achieve sustainable development of Northern regions. Finland has many years of experience in oil spill prevention, response methods and recovery technologies in ice. This knowledge can be shared and utilized in other countries.

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