SAFGOF - Evaluation of the Traffic Increase in the Gulf of Finland During the Years 2007 - 2015 and the Effect of the Increase on the Environment and Traffic Chain Activities

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Maritime traffic in the Gulf of Finland increased remarkably during the 2000's and it is expected to increase further during the coming years. Unfortunately, the growing maritime traffic will also increase the environmental risks through direct environmental effects and rising accident risk. The project SAFGOF studied in a cross-disciplinary manner, how the traffic patterns are estimated to change in the Gulf of Finland by the year 2015. Based on these estimates, the effects on risk levels for ship collisions and groundings were studied. In addition, environmental effects of an oil accident were modeled based on the traffic patterns and collision risks. Maritime safety policy instruments were studied in order to find effective ways to prevent an oil accident. Some risk control options were also tested in the so-called SAFGOF meta-model, which combines social, technological and environmental information. Furthermore, intermodal supply chain was studied in order to find out better risk control options. SAFGOF project began in January 2008 and it ended in April 2011.

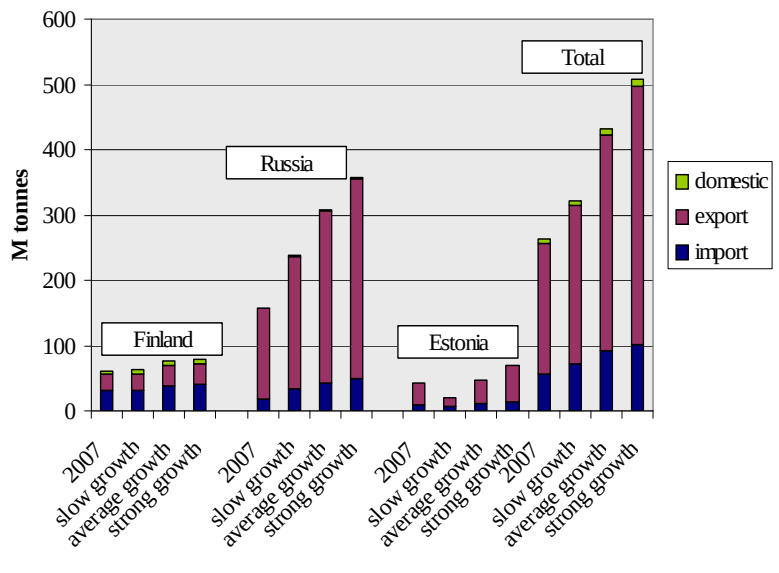
WP 1 – Maritime transportation in the Gulf of Finland in 2007 and 2015 (University of Turku)

In WP 1 the cargo flows in maritime traffic in 2007 were studied and the three alternative scenarios were made for the year 2015. Each scenario was based on certain assumption about economic development:

- the slow growth scenario - economic recession
- the average growth scenario – quick recovery
- the strong growth scenario – the most optimistic visions will come true.

Scenarios were formulated on the basis of previously made transportation scenarios and other visions for future. Generally it is believed that the growth of maritime traffic will continue also in future. The development of Russian economy and oil industry are the key issues for the future of maritime traffic in the Gulf of Finland. The results of the WP 1 work as inputs for other WPs and for the SAFGOF meta-model.

SAFGOF-scenarios for the Gulf of Finland

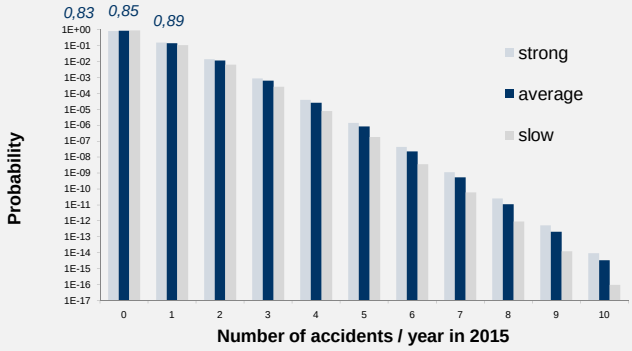


WP 2 – Accident probability estimation (Aalto University)

Collision probabilities were estimated for the Gulf of Finland for 2008 maritime traffic and for the three 2015 traffic scenarios (from WP 1). For various smaller areas in the GOF, the accident probability estimates were also calculated given certain risk management actions (from WP 6). With the model, the estimated expected number of collisions in the Gulf of Finland in 2008 was 0.19 per year and the most collision-prone area was found to be the eastern part of the gulf. The expected value for the 2015, given average traffic scenario, was 0.52 collisions per year.

The collision proneness of the waterway fractions and crossings in the Gulf of Finland for maritime traffic in 2008. Red indicates the highest number of collisions

The probability distribution of the number of tanker collisions per year for three 2015 traffic scenarios. The probability values of no collisions are printed in upper left corner



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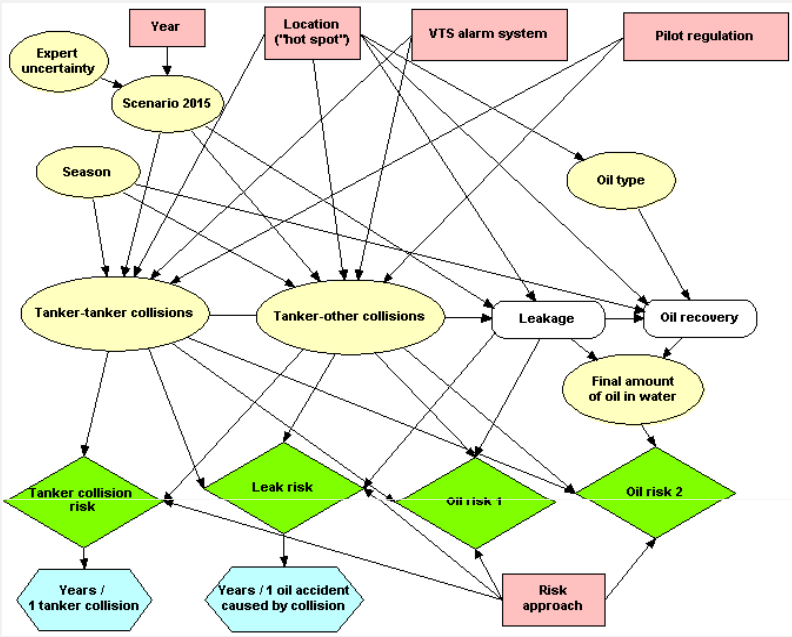
WP 3 – Environmental risks of maritime traffic 3 (University of Helsinki)

The growing maritime traffic, including oil transportation, in the Gulf of Finland will increase the probability of a major oil accident, thus adding the risks posed towards the ecosystem. This is happening both via the growing amount of oil transported and the increasing number of vessels navigating in the Gulf of Finland.

In WP 3, a multidisciplinary risk assessment and decision support tool by applying Bayesian Belief Networks was developed. The tool integrates the future alternative scenarios and accident probabilities created in WPs 1 and 2. The probabilistic meta-model consists of several sub-models about collision and causation probability created in WP 2, as well as the resulting leak size and the efficacy of open sea oil recovery. The meta-model can be used to compare the selected preventive management actions (from WP 6) with the accident probabilities. The multidisciplinary approach helps in comparing the risks in the different parts of the oil accident chain when the current knowledge and uncertainty are taken into account which is the most important utility gained in this study.

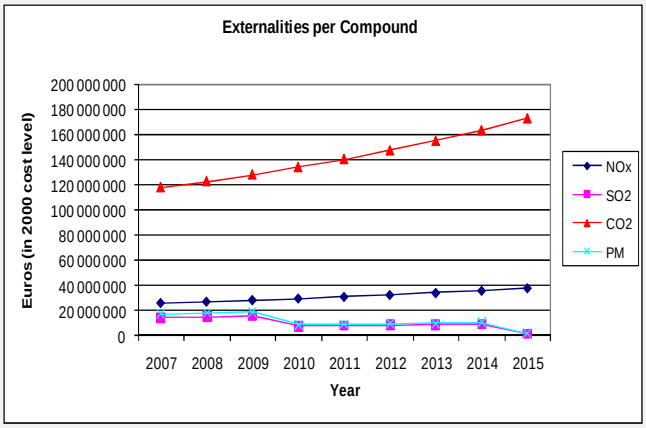
With the user interface for the evaluation of ecological risks, the results are further utilized to calculate probabilistic oil drifting maps that are combined with the information of endangered species populations on the Finnish coastline. The approach produces unique information on the environmental oil accident risks separately for accident-prone areas in the Gulf of Finland, which enables efficient local risk control actions to be analyzed by the decision makers.

Structure of the SAFGOF meta-model. The pink rectangles are decision variables, the yellow ovals are random variables, the white angulated ovals are sub-models, the green quadrangles are utility variables and the blue hexagons are function variables.



WP 4 Emission externalities in the Gulf of Finland in 2015 (University of Turku)

Air emissions of maritime traffic are problematic in many ways – they are causing eutrophication of the Baltic Sea or health problems to humans. One method to estimate the costs of ship-originated air emissions is to calculate their externalities. In WP 4 CO_2, NOx, SOx and PM emissions originating from ships and their externalities in the Gulf of Finland until 2015 have been studied. The calculation algorithm developed in this study produces emission estimates per annum and converts them into externalities. The total external cost of ship-originated CO_2, NOx, SOx and PM emissions in the Gulf of Finland was almost 175 million Euros in 2007. Due to increased traffic volumes, these costs will increase to nearly 214 million Euros in 2015. Scenario modeling is also a method for estimating the effects of forthcoming or planned regulations, and it helps to target emission abatement actions to maximize their profit.



WP 5 - The way of acting in the transport chain (Kymenlaakso University of Applied Sciences)

The main aim of the study was to find out interfering parameters affecting the intermodal supply chain management in ports. In order to define different disturbances in ports a questionnaire survey was made for the stakeholders. Both electronic questionnaire format and free format questionnaire were used. The survey clearly identified a group of risks related to the intermodal transport chain. Both frequencies and consequences of interferences were estimated and classified into different risk classes. Some findings made were further selected to be studied in more detail to define suitable risk control options or best practices to avoid unwanted events.

The aim of this study was to continue to find out better risk control options to be used in the target ports of this study. Thus a set of small projects and studies will be carried out to produce tailor-made solutions to avoid risks identified in operational procedures. The focus is also directed on finding out best practices and lessons learned for other ports than the target ports of this study with tailor-made courses for the stakeholders. The next step is trying to evaluate the impacts of global changes and restructuring the development of the area.

WP 6 – Policy instruments (University of Turku)

Numerous policy instruments are used in international, EU, regional and national level to minimize maritime safety risks, for example the oil accident risks in the Gulf of Finland. In this WP these instruments and their effectiveness were studied e.g. with a questionnaire to Finnish maritime experts. On the basis of the results, the development of VTS operations and piloting ranked as most effective ways to prevent an oil accident in the Gulf of Finland. Three different risk control options were developed around these issues and their effect on accident probabilities was tested in the SAFGOF meta-model. In addition, human factor related issues and their importance to maritime safety in future stood out from the questionnaire results.

WP 7 – Training (Kymenlaakso University of Applied Sciences)

The aim of this workpackage was to advance new knowledge, such as new practices generated in the other workpackages and spread this knowledge through education and seminars. preparing new virtual-based material was prepared and material for futher needs was processed. Activities included also public lectures and specialist meetings.

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