Ministry of the Environment of Estonia

Review of the transboundary EIA of the Nord Stream gas pipeline

compiled by the Working Group at the Estonian Ministry of the Environment
on the evaluation of the transboundary environmental impact assessment
(EIA) report of the Nord Stream gas pipeline

Tallinn 2009

Executive summary

1. The scope and process of the evaluation

This evaluation concerns the "Espoo EIA report" of the Nord Stream gas pipeline presented by the Developer (Nord Stream AG) under the Espoo Convention to the affected parties on March, 9, 2009 for evaluation, consultations and the public hearings. On additional request, the following further materials were received or made available via Developer´s home page from March, 9, 2009: the Finnish and Danish national EIAs (in English), the Swedish and German national EIAs (in national languages). Four additional reports were presented by Ramboll as a response to the request through the Finnish Competent Authority to provide all relevant original data and study reports, according to the transparency statement in the EIA report. Other relevant sources for this review include reports, press releases and other public domain information, documents provided by the developer and the countries of origin and protocols of international consultations and a public hearing in Tallinn on April, 29, 2009.

Also, the Russian national EIA was requested as an important source of underlying information of the Espoo EIA. The reply from the Russian Ministry of Natural Resources and Environment stated that (i) the ministry has no provisions in the Espoo Convention to include national EIAs in the Documentation for the Consultations and (ii) the Espoo Consultations should be based on the information already provided by the Developer.

The Espoo EIA has been assessed in the context of up-to-date scientific knowledge and available expertise by the expert group formed in July, 2008 by the Minister of Environment of Estonia. Current document should be considered as collection of comments and opinions expressed by the members of expert group on several relevant chapters and parts of the Espoo report and national EIA reports. Chapters of the current review document express opinions and views of participating experts.

Due to its relevance in the context of permitting process, this evaluation focuses mainly to the major risks to the Baltic Sea environment and specifically on the risks related to the transboundary impact to Estonia in the construction phase.

2. Legal background and the evaluation criteria

Four of the five countries assigned to the parties of origin in the project (Finland, Sweden, Denmark and Germany) and all four countries assigned to the only affected parties (Poland, Lithuania, Latvia and Estonia) are the Member States of the European Union who are responsible for applying the EU EIA directive, habitat and bird directives and all other relevant acts of the EU legislature and national legislature and international treaties in the context of transboundary and national environmental impact assessment.

Russia has stated its willingness to participate in the Espoo EIA process, but has not ratified the Espoo Convention. Therefore, the most relevant institutions who can guarantee that the entire EIA process will conform to the international treaties and the EU legislature, are the authorities of these four parties of origin who are the EU Member States. As an affected party, Estonia has a responsibility to present the comments on the statements on the overall impact of the project and to communicate specific concerns on transboundary impacts to Estonia.

The expert group at the Estonian Ministry of the Environment used the evaluation criteria of the environmental statements based on the EU EIA directive and its supplementary materials provided by the European Commission, including the following recommended grading system:

A: Full provision of information with no gaps or weaknesses
B: Good provision of information with only very minor weaknesses which are not of importance to the decision
C: Adequate provision of information with any gaps or weaknesses in information not being vital to the decision process
D: Weak provision of information with gaps and weaknesses which will hinder the decision process but require only minor work to complete
E: Very Poor provision of information with major gaps or weaknesses which would prevent the decision process proceeding and require major work to complete.

3. General comments on the completeness of the report

The most relevant **major gaps** of information within the EIA include (but are not limited to):

- missing information on the Russian Exclusive Economic Zone (EEZ), in particular all the data concerning munitions and chemicals that may be released from the seabed in course of the seabed intervention works;

- missing studies of the impact of dioxins that potentially would be released from the seabed, in particular from the Finnish and Russian EEZ-s, especially in the context of the pollution of the Gulf of Finland through the Kymi River from 1940 to 1984;

- missing studies of all the hazardous substances on the HELCOM list in the sediments deeper than 6 cm;

- inadequate evaluation of the long-term remobilisation of nutrients and hazardous substances, both as a consequence of the changes in the properties of near-bottom currents owing to continuous changes in the seabed due to the pipeline construction and maintenance and owing to specific features of hydrodynamic activity in the vicinity of the pipelines that will form new barriers;

- incomplete and inaccurate information on the conventional and chemical munitions in the EEZs of all parties of origin and mercury containers in the EEZs of Sweden and Denmark;

- controversial information on certain aspects of the project presented in the Espoo EIA and in the public hearings, in particular, missing environmental impact assessment of (i) the higher pressure pipeline after abandoning the platform near Gotland, (ii) the number and locations of conventional munitions to be exploded and (iii) the missing assessment of environmental impact and risks of using the dynamic laybarge in the Gulf of Finland;

- unclear and controversial risk analyses, including the consequences of the break-up of the pipeline, due to the incomplete or obsolete data on seabed geology, tectonics and seismicity, and owing to interaction with ship traffic;

- incomplete evaluation of cumulative risks in the context of potential crossing crossing of the pipelines in question with the planned Balticconnector pipeline.

- incomplete evaluation of cumulative risks in the context of the EU habitat and bird directives, including, but not limited to cumulative effects of nutrient and toxic matter release to the foodweb, impact of toxic contamination of fish to piscivorous birds and mammals, potential future Natura 2000 areas in the 20 km impact corridor.

Pending on the EU EIA directive, a key document in the legal basis of implementing the Espoo Convention in the EU, and the EU guidelines linked to the Espoo EIA should include the aspects that are currently missing:

- assessment of the environmental impact of alternatives, including the overland alternatives;
- assessment of the environmental impact of all subcontracted activities, including the production and preparation of materials, such as parts of the pipeline.

Pending on the Espoo Convention and the EU EIA directive, the EIA should include a comprehensive and adequate analysis of <u>transboundary impacts to Estonia.</u> Such an analysis is currently almost missing. The topic is presented only as a list of statements in the

Espoo EIA and is not supported by the relevant data, their analysis and arguments used for reaching to the conclusions. The situation, where the statements are not supported by evidence and argumentation, is not acceptable.

4. Conclusions and recommendation for continuation of the transboundary consultations

Based on our findings described above, the expert group regrets that the information presented by the Developer so far is incomplete for full-scale evaluation of the environmental impact and the related risks. The documentation provided does not meet the quality criteria of the EU EIA directive and related guidelines, because it provides information with major gaps or weaknesses which prevent the decision process proceeding and require major work to update the information to meet the best practice of the EIAs.

It should be emphasized that so far, the expert group could give only partial evaluation of the gaps and weaknesses of the entire EIA process, because of the lack of the information about potential impacts stemming from the construction of the pipeline adjacent to the Estonian EEZ. Consequently, neither the expert group nor the public had an access to the relevant information during the public hearing in Estonia on April 29. Due to the incompleteness of the presented documentation, with major gaps in the most relevant information on the risks and the baseline situation, the expert group expresses the concern whether the entire Espoo EIA process, or its certain stages, have been legitimate.

It is recommended that the Estonian Point of Contact, the Ministry of the Environment will continue the consultations with the Competent Authorities of the Parties of Origin, to continue to give input and receive feedback in order to ensure that all the aspects of permitting processes of the parties of origin would be in compliance with the EU legislature and all relevant international agreements and conventions.

In particular, our concern is that the Parties of Origin will be notified to take the necessary measures to guarantee that (i) the EIA report should be completed according to the EU EIA directive and other relevant legislature before any permitting process can be started, (ii) all investigations will be completed before any further EIA report will be accepted for a review and (iii) no activities of the project causing environmental impact will be carried out before the EIA will comply with the EU legislature and will be approved, (iv) if any violation of the legislature of the EU or the Member States will be discovered in the context of the Nord Stream EIA and permitting process, the process will be stopped until the legal situation will be clarified.

Contents

Introduction

The scale of the planned Nord Stream project – construction and operation of 2 more than 1200 km long pipelines through the Baltic Sea is such that it will inevitably cause environmental impacts to the Baltic Sea. In view of the magnitude of this project, it would potentially affect the ecosystems and human health in the Baltic Sea Region and would thus have impact to ecosystem services and life quality on the shores of the Baltic Sea. Due to different approaches to sustainability and environmental questions, the complexity of environmental perspective and sustainable development may be sometimes overlooked by the developers of the commercial projects. This introductory chapter highlights some relevant basic principles and priorities in maintaining the environment and life quality in the Baltic Sea Region.

Priorities of the development of life quality and ecosystem services in the Baltic Sea Region

The year 2010 will be celebrated as an International Year of Biodiversity, to promote the activities outlined in the Convention of Biological Diversity. In 2001, EU Heads of State and government agreed to halt the decline of biodiversity in the EU by 2010 and set an objective to secure the recovery of habitats and natural systems. In 2002, the Convention of Biological Diversity adopted its strategic plan which includes the overall target to significantly reduce the rate of biodiversity loss by 2010. In 2006, this goal was targeted in the communication of the EC on halting the loss of biodiversity by 2010, with its 82-page annex outlining the EU priorities[1].

In particular, this document states (p. 11-12): *"Humans are part of biodiversity and depend on many life support systems provided by biodiversity and ecosystems. Ecosystems provide a stream of services, the continued delivery of which is essential to our economic prosperity, security, health and other aspects of our quality of life. These 'ecosystem services' include the air we breathe, and the provision of goods such as food, fibre, fuel, freshwater and medicines. They include the regulation of climate, flooding, disease and water quality. They include essential supporting services such as soil formation, nutrient cycling, pollination and primary production. And they include cultural services such as aesthetic, educational, recreational,*

[1] http://ec.europa.eu/environment/nature/biodiversity/current_biodiversity_policy/biodiversity_com_2006/pdf/sec_2006_607.pdf

psychological and spiritual benefits. […] The more we lose biodiversity, the more ecosystem services are put at risk."

The ecosystem of the Baltic Sea is seen as one of the most vulnerable ones:

"*There is established but incomplete evidence that changes being made in ecosystems are increasing the likelihood of non-linear changes in ecosystems (including accelerating, abrupt, and potentially irreversible changes), with important consequences for human well-being. Thresholds exist within ecosystems, which, if crossed, cause the ecosystem to switch to a different structure or functioning. Generally, the more diverse an ecosystem, the further it is from such a threshold and thus the more resilient it is to pressures. The loss of species and genetic diversity, and increasing pressures, push ecosystems towards such thresholds. […] In some cases – such as in the Baltic Sea - thresholds may already have been passed."* (p. 22).

Long-term economic effects of the declination of ecosystem services are pointed out:

"*The costs of non-action are potentially immense – in terms of lost assets, goods and services. The degradation of ecosystem services represents the loss of 'natural capital'. The loss of this capital (or wealth) due to ecosystem degradation is however not reflected in conventional national accounts. For example, a country could cut its forests and deplete its fisheries, and this would show only as a positive gain in Gross Domestic Product (GDP) without registering the corresponding decline in assets (wealth). A number of countries that appeared to have positive growth in net savings (wealth) in 2001 actually experienced a loss in wealth when degradation of natural resources was factored into the accounts*." (p. 29)

The responsibility of the Member States is summarized as follows:

"*Action for the EU's most important habitats and species is key to halting biodiversity loss by 2010 and fostering recovery. Securing these habitats requires greater commitment from Member States to propose, designate, protect and effectively manage Natura 2000 sites. It also requires that they strengthen coherence, connectivity and resilience of the network, including through support to national, regional and local protected areas. Targeted action for threatened species under the directives is a vital complement to the site-based approach. Conservation measures comparable to those provided for by the nature directives are required in those EU outermost regions not covered by these directives. Beyond these community-level instruments, better planning at Member State level holds the key to preventing, minimising and offsetting negative impacts of regional and territorial development on biodiversity, thereby reconciling development with conservation*." (p. 48)

An emphasis is given to strengthening of EU decision making, involving "*improving coordination and complementarity between Community and Member States; ensuring new policies and budgets take due account of biodiversity needs (notably by recognising natural* *capital and ecosystem services); improving coherence at national level between various plans and programmes affecting biodiversity; and ensuring decision-making at regional and local level is consistent with high-level commitments for biodiversity*."

The targets include establishing and safeguarding the Natura 2000 network, coherence of the protected areas network and reaching the situation where no priority species will be in worsening conservation status by 2010 (p. 68-69).

The instruments of the conservation of environment in the EU and the Baltic Sea Region

The International Maritime Organization has decided in 2005 that the Baltic Sea is a particularly sensitive sea area – an area significant for ecological or socio-economic or scientific reasons and which may be vulnerable to damage by international maritime activities.

According to the United Nations Convention on the Law of the Sea the states shall take all measures necessary to ensure that activities under their jurisdiction or control are so conducted as not to cause damage by pollution to other states and their environment.

In the EU, the instruments of the conservation of environment include the legislature of the EU and the Member States, international agreements signed by them, and various action plans developed and carried out by international organizations and commissions.

The need to fully apply the Habitats and Birds Directives to the offshore marine environment of the European Union, especially with regards to the establishment of the Natura 2000 network, represents a key challenge for EU biodiversity policy in the coming years.

The establishment of a marine network of conservation areas under Natura 2000 will significantly contribute, not only to the target of halting the loss of biodiversity in the EU, but also to broader marine conservation and sustainable use objectives[2]. **In this context, any potential future Natura 2000 marine areas should be taken to the account in the environmental impact assessments of any development projects.**

The Helsinki Commission, or HELCOM, works to protect the marine environment of the Baltic Sea from all sources of pollution through intergovernmental co-operation between Denmark, Estonia, the European Community, Finland, Germany, Latvia, Lithuania, Poland, Russia and

[2] http://ec.europa.eu/environment/nature/natura2000/marine/index_en.htm

Sweden. HELCOM is the governing body of the "Convention on the Protection of the Marine Environment of the Baltic Sea Area" - more usually known as the Helsinki Convention[3].

One of the most important duties of the Helsinki Commission (the governing body of the convention) is to make Recommendations on measures to address certain pollution sources or areas of concern. These Recommendations are to be implemented by the Contracting Parties through their national legislation. Since the beginning of the 1980s HELCOM has adopted some 200 HELCOM Recommendations for the protection of the Baltic Sea. Another important duty is to follow up the implementation of the Convention and HELCOM Recommendations. This implies that all involved countries should report to the commission on a regular basis.

The HELCOM contracting parties have signed in November, 2007 an action plan to achieve a good environmental status of the Baltic Sea by 2021[4]. Among others, the following main ecological objectives of the Baltic Sea Action Plan are defined:

- concentrations of nutrients close to natural levels;
- natural oxygen levels;
- concentrations of hazardous substances close to natural levels;
- all fish safe to eat;
- natural marine and coastal landscapes;
- minimum threats from offshore installations.

The **Stockholm Convention** on Persistent Organic Pollutants is a global treaty to protect human health and the environment from chemicals that remain intact in the environment for long periods, become widely distributed geographically and accumulate in the fatty tissue of humans and wildlife. Exposure to Persistent Organic Pollutants (POPs) can lead serious health effects including certain cancers, birth defects, dysfunctional immune and reproductive systems, greater susceptibility to disease and even diminished intelligence. Given their long range transport, no one governing acting alone can protect is citizens or its environment from POPs. In response, the Stockholm Convention, which was adopted in 2001 and entered into force 2004, requires Parties to take measures to eliminate or reduce the release of POPs into the environment[5].

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[3] http://www.helcom.fi/

[4] HELCOM Baltic Sea Action Plan, adopted on 15 November 2007 in Krakow, Poland by the HELCOM Extraordinary Ministerial Meeting. 101 p.

[5] http://chm.pops.int/Convention/tabid/54/language/en-US/Default.aspx

There is a growing concern of the impact of the Baltic Sea to the human food quality, due to the contamination of fishes with dioxins and other organic pollutants. The COMMISSION REGULATION (EC) No 199/2006 of 3 February 2006 amending Regulation (EC) No 466/2001 setting maximum levels for certain contaminants in foodstuffs as regards dioxins and dioxin-like PCBs states (paragraph 11):

"*Derogations have been granted to Finland and Sweden to place on the market fish originating in the Baltic region and intended for consumption in the territory with dioxin levels higher than those set in point 5.2 of section 5 of Annex I to Regulation (EC) No 466/2001. Those Member States have fulfilled the conditions as regards the provision of information to consumers on dietary recommendations. Every year they have communicated the results of their monitoring of the levels of dioxins in fish from the Baltic region to the Commission and have reported on the measures to reduce human exposure to dioxins from the Baltic region.*"

In case the toxicity of the fishes will decrease, Finland and Sweden may be able to sell the fish to the EU after a transitional period of monitoring: "*On the basis of the results of monitoring of levels of dioxins and dioxin-like PCBs carried out by Finland and Sweden, the transitional period during which the derogations granted to those Member States apply should be extended, but those derogations should be limited to certain fish species. Those derogations apply to the maximum levels for dioxins and to the maximum levels for the sum of dioxins and dioxin-like PCBs set in point 5.2 of section 5 of Annex I to Regulation (EC) No 466/2001.*"[6]

As "all fish safe to eat" is a HELCOM priority, it implies to all HELCOM contracting parties. HELCOM has recently adopted a recommendation to reduce airborne input of dioxins to the Baltic Sea. It is well-documented in scientific publications that a potential release of the contaminants carried to the seabed from the mouth of the Kymi River would cause a pollution that would be several magnitudes higher. For the EU Member States, it is relevant to prevent the appearance of new point sources of toxicants, such as remobilisation from the seabed sediments during the seabed interventions, especially in the context of the current situation of the toxicity of fishes.

The targets of HELCOM, international conventions and the EU directives are supporting the framework of the priorities necessary for the sustainable development of the region and ensuring the safe and healthy environment that have been built up during several decades. Any large-scale development project should estimate how it fits to this framework of regional development and to consider all the feasible alternatives, including the overland alternatives.

[6] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2006:032:0034:0038:EN:PDF

1. Impacts Occurring during the Construction Phase

1.1. Increase in turbidity, impact on the water column and marine benthos

Statement on the quality of the report

Environmental impacts occur due to the munitions clearance, seabed intervention works (dredging, trenching, rock placement and support structures). In the Gulf of Finland, the impact scale is assessed as regional and significance as minor.

The gaps and uncertainties of the assessment are not acceptable because:
1) the model (MIKE 3 HD + MIKE PA) used for the impact assessment has not been calibrated and verified by near-bottom flow measurements[7], since these measurements have not been made (see also 4.2.1);
2) remobilization and spreading of fine sediments with destroyed cohesive structure has not been assessed (in this case much smaller near-bottom flows are needed for resuspension[8]).

These gaps can be overcome by making the near-bottom flow measurements, doing the extensive model validation and including the resuspension of sediments originating from the construction phase works, and by including the data from the whole area of the Gulf of Finland.

1.2. Seabed interventions and remobilisation of hazardous substances

Statement on the quality of the report

Information on re-mobilisation of hazardous substances in the process of seabed interventions in course of construction works and munitions clearance in the EIA report is incomplete. The EIA report implies that throughout the Baltic Sea only upper 6 cm of the sediment has been studied for certain metals and organochlorine substances. However, these results have little bearing to the risks of release of the toxicants in case of seabed interventions, at least in the Gulf of Finland, where the highest concentrations of toxicants are

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7 "The validation of the MIKE 3 HD flow model is based on a very small amount of measuring observations, and the seabed currents were validated in the main basin of the Baltic Sea only. Local benthic currents occupy a significant role in calculating the spreading of turbidity caused by aquatic works". Natural gas pipeline through the Baltic Sea. Environmental impact assessment in the exclusive economic zone of Finland. APPENDIX XI: Report on the Water Quality Modelling of the Nord Stream Gas Pipeline. Author: Luode Consulting Ltd, p. 8.

8 Schoellhamer D.H., 1996. Anthropogenic sediment resuspension mechanisms in a shallow microtidal estuary. Estuarine, Coastal and Shelf Science, 43 (5), 533–548

known to occur between 8-40 cm of the sediment. Information on hazardous substances in the sediment column in the Russian EEZ has not presented, although HELCOM documents and some previous publications refer to very high concentrations of toxicants in the eastern part of the Gulf of Finland. The scientific information and the public domain information available on the release of dioxins and methyl mercury to 1/3 of the Gulf of Finland from the Kymijoki River indicate high risks of remobilization of the hazardous substances.

To complete the studies on toxicants, it will be necessary to study the sediment column for up to 40-50 cm, with the emphasis to all the toxicants on the HELCOM hazardous substance list, including dioxins and furans included to numerous EC regulations and EU directives. Changes in redox conditions of the bottom sediments should be taken into the consideration in dealing with the mobile forms of cadmium and mercury (MeHg). The analysis of the transboundary impacts to Estonia that is missing, should be included.

In earlier discussions of subsea pipelines in the Gulf of Finland, Finnish experts have indicated that in case of the planned seabed interventions, due to the EU regulations, the toxic bottom sediments in the Gulf of Finland polluted by the Kymijoki River should be first removed and dumped to the landfills in the mainland of Finland. A similar action plan recently compiled for the Kymijoki River is costly and not without risks. The risk analysis of the seabed sediment removal should be included to the EIA.

Release rates of hazardous substances into the water column are proportional to the sediment spill rates. The sediment spreading assessment has uncertainties described in chapter 1.1 that have to be solved.

The information available on inputs and sources for hazardous substances is much scarcer than that on nutrients and does not allow for comprehensive assessment of the situation in the Baltic Sea at present (HELCOM 2007).

Hazardous substances listed in HELCOM recommendations (Annex 1 of current chapter), Stockholm Convention and the EU Water Framework Directive should be of the highest priority. In the project, there are no data available for a great number of hazardous substances, listed in the HELCOM recommendations, Stockholm Convention and the EU Water Framework Directive in the water column, and in great extent in sediments and biota. Based on the impact assessments conducted for both the national Finnish EIA and the Espoo procedure, the following aspects should be given highest priority in the environmental monitoring programme: for documenting the baseline situation, monitoring of hazardous substances in sediments (under sediment depth line 5 cm) and fish species (About 90% of the human intake of dioxins comes from fatty food including Baltic Sea fish (Dioxins in the Baltic Sea 2004)) should be carried out along the pipeline route and in pipeline area before and after the construction phase, especially in the ecological sub-regions 1-3 (Gulf of Portovaya, Gulf of Finland and Open Baltic). Extensive seabed interventions in the Gulf of Finland would result in massive release of dioxins and other contaminants into food web.

According to the classification of the Swedish Environmental Protection Agency (EPA, Naturvardsverket 1999, Vallius & Leivuori 2003), the state of surface sediments in the Gulf of Finland was not satisfactory: sediments were "significantly" or "largely" polluted with heavy metals (Annex 2).

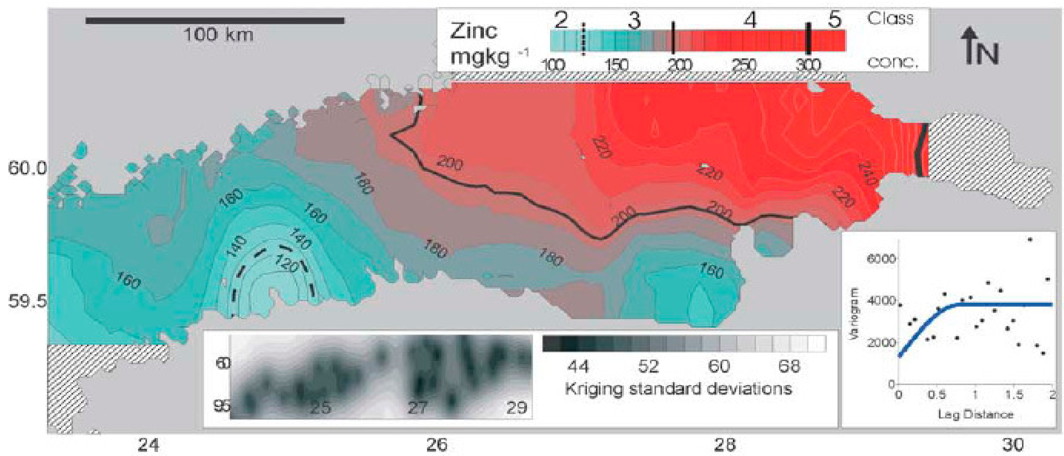

Figure 1. Quality classification of surface sediments (0–1 cm) in the Gulf of Finland. Class 1 little or no contamination, 2 slight contamination, 3 significant contamination, 4 large contamination and 5 very large contamination. (Classification based on ranges used by the Swedish Environmental Protection Agency, EPA, Naturvårdsverket 1999, Vallius & Leivuori 2003, Perttilä et al., 2006).

Over the years, and especially in case of the change in redox conditions due to the seabed interventions, some of these metal deposits will be transformed into hazardous compounds (including organic methyl-mercury), so their release back into the marine ecosystem may result in very harmful effects to to ecosystem and human health (Perttilä et al., 2006), including brain damage during embryonic development. Risk assessment and assessment of transboundary impacts due to fish migration were not conducted in the EIA. In the Estonian coastal waters, the longest migration for fish was over 160 km from the tagging site (Järv, 2000; Roots et al., 2003a), In practice, it means that it is highly unlikely, that the fishes of the Gulf of Finland that will be contaminated in the Finnish and Russian EEZs, will not be occasionally caught in Estonian waters. Hence any impact in the sea animals within the Gulf of Finland is of inevitable siginficance in the transboundary impact, affecting sea mammals, piscivorous birds and humans.

There are indications that contaminated sediments may have a regional impact on fish contamination levels. However, as yet there is no robust statistical evidence linking contaminated sediments with elevated levels in Baltic biota (Sundqvist et al, 2009). No sediment and fish species-specific bioaccumulation data are available at all for Kymijoki polluted region (Gulf of Finland). Up to 24000 tons of wood preservative, chlorophenol (known as Ky-5), was manufactured in the upper reaches of the Kymijoki River between 1940 and 1984, which polluted the Kymijoki River and the bottom sediments in 1/3 of the Gulf of Finland (Isosaari, 2004). Total TEQ (approximately) – 28 kg- PCDD/Fs. Total TEQ at the same level as Seveso disaster in Italy (30 kg) (Weber et al., 2008a,b). According to Morcanelli, 2001, in Seveso there was an increase of tumors involving the lymphoid system. Verkasalo et al., 2004 did not exclude the possibility that residence near the Kymijoki River may have contributed to a small-scale increase in cancer risk. The reason for high mortality of the ringed seals in the eastern part of the Gulf of Finland in the autumn of 1991 and related finds of about 150 carcasses mostly in the Russian part of the bay is not solved up to now (Koistinen et al., 1997).

The environmental information that Nord Stream project developers are required to provide under the EIA (Environmental Impact Assessment) procedure is defined in Article 5(3) and Annex IV of Directive 97/11/EC. Article 5(3) subsection 3 requires that the information must include “at least the data required to identify and assess the main effects which the project is likely to have on the environment”. Where the Environmental Impact Statement is considered to be inadequate, the developer will be asked to provide additional information and the development consent decision process will not start until this information has been provided.

EIA evaluation table according to “Guidance on EIA, EIS Review” (European Commissions 2001)

SECTION 3. DESCRIPTION OF ENVIRONMENT LIKELY TO BE AFFECTED BY THE PROJECT				
No.	Review question	Relevant?	Adequately Addressed?	What further information is needed?
	Aspects of the Environment			
3.5	Are species populations and characteristics of habitats that may be affected by the Project described and are any designated or protected species or areas defined Is the fish contamination described in an adequate level (Chapters 7, 8, 9 and 11).	YES	NO	EIA report dose not contain bioaccumulation data for hazardous substances in fish species. Bioaccumulation in fish varies between fish species, depending, e.g., on fat content in fish. Contaminant concentrations in local fish may rise (Olsson et al., 2002; Roots et al., 2003a,b;2004; Dioxins in the Baltic Sea, 2004; Shelepchikov, al., 2008). By the Russian data (Shelepchikov, et. al., 2008): “The special concern is caused by the high concentration of dioxin-like PCBs whose contribution to the total WHO-TEQ usually considerably exceeds the contribution of PCDDs and PCDF. Hence, if one takes into consi-deration WHO-PCBs, then total WHO-TEQ of all studied sea fish and its products are near or exceed levels established by the EC Council maximum level for fish and fishery products in the Russia (Open Baltic Sea) economic zone (Commission regulation (EC) No 1881/2006;Annex 3).
3.5	Are the fish migration described an adequate level (Chapter 9)	YES	NO	Risk assessment for fish migration is lacking in the EIA. In the Estonian coastal waters, the longest migration for fish was over 160 km from the tagging site (Järv, 2000; Roots et al., 2003a).
3.6	Is the water environment of the area described (Chapter 7,8 and 11)	YES	NO	The analyses of the hazardous substances in the first ecological sub-region (the Portovaya Bay) are lacking. According to the Russian data (Frumin & Basova, 2006) in the Mouth of the Neva River level of total water pollution increased from 1990-2005. According to the classi-fication of the Swedish Environmental Protection Agency (EPA, Naturvardsverket 1999, Vallius & Leivuori 2003)., the state of surface sediments in the eastern part of Gulf of Finland was not satisfactory: sediments were “significant” or “largely” polluted with heavy metals (Annex 2 and Figure 1).
3.6	Is the water environment of the area described (Chapter 7,8 and 11)	YES	NO	The information available on inputs and sources for hazardous substances is much scarcer than that on nutrients and is not sufficient for the assessment of the present situation in the Baltic Sea (HELCOM 2007). In order to localize hotspot areas and trace sources, comprehensive analysis of hazardous substances (heavy metals, PAH, POPs, etc.) in the Baltic Sea biota, surface sediment needed in all areas of the Baltic Sea that have not been previously investigated, including the eastern part of the Gulf of Finland (Mouth of Neva River). The EIA has missed the provision of the data on several relevant hazardous substances, listed in the HELCOM recommendations, Stockholm Convention and the EU Water Framework Directive for the water coloumn, sediments

				and biota.
	Data collection and Survey Methods			
3.18	Have sources of data and information on the existing environment been adequately references ?	YES	NO	The EIA does not include sediment and fish species-specific bioaccumulation data are for the Kymijoki polluted region (Gulf of Finland). Extensive seabed interventions in the Gulf of Finland (as well as in the Baltic Sea) would result in massive release of dioxins and other contaminants into foodweb. After the release, the PCDD/Fs, DL-PCBs and other toxicants, associated with finest sediment particles, plankton, fish, etc., travel far with cur-rents, accumulate in micro-organisms, phyto- and zoo-plankton, and reach consecutively higher concentrations in the higher trophic levels of the foodweb: in fishes, birds, sea mammals and finally, in the highest concentrations, in humans (Annex 3). These most relevant risks are not evaluated.
SECTION 4. DESCRIPTION OF THE LIKELY SIGNIFICANT EFFECTS OF THE PROJECT				
	Prediction of Direct Effects			
4.7	Are direct, primary effects on fauna and flora and habitats described and where appropriate quantified ? (Chapter 11)	YES	NO	The EIA states that the transboundary impact resulting from the remobilisation of the hazardous substances is insignificant. This statement is not supported by the materials presented in the report. Dioxins, and other toxicants fixed in the sediment can be released and potentially be resuspended in the water column and so potentially be re-absorbed within the foodweb. There are only few hazardous substances data, no sediment and fish species bioaccu-mulation data, available from the first ecological sub-region (Russian economic zone). No sediment and fish species bioaccumulation data are available for the region in the Gulf of Finland polluted by the Kymijoki.
	Prediction of Effects on Human Health and Sustainable Development Issues			
4.26	Are primary and secondary effects on human health and welfare described and where appropriate quantified	YES	NO	An increased risk of low birth weights in infants, especially boys, has been associated with a high consumption of contaminated fish from the Baltic Sea by their mothers (Rylander et al., 1995; Agrell et al., 2001). Also, breast cancer incidents were higher than expected in women from the Baltic coast. These women consumed locally caught fatty fish at least twice as often as the control group (Rylander and Hagman 1995; Agrell et al., 2001). In humans, accidental or occupational exposure to high doses of PCDD/Fs and/or PCBs have caused lesions of skin, chloracne, development defects, and increased the risk of cancer (Kiviranta 2005). No sediment and fish species bioaccumulation data are available at all for Kymijoki polluted region (Gulf of Finland). Up to 24000 tons of wood preservative, chlorophenol (known as Ky-5), was manufactured in the upper reaches of the Kymijoki River between 1940 and 1984, which polluted the Kymijoki River and the bottom sediments in 1/3 of the Gulf of Finland (Isosaari, 2004).Total TEQ (approximately) – 28 kg- PCDD/Fs. Total TEQ at the same level as Seveso disas-ter in Italy (30kg)(Weber et al., 2008a,b). By the data (Morcanelli, 2001), in Seveso there was an increa-se of tumors involving the lymphoid system. By the

				Russian data (Shelepchikov, et. al., 2008): “The special concern is caused by the high concentration of dioxin-like PCBs whose contribution to the total WHO-TEQ usually considerably exceeds the contribution of PCDDs and PCDF. Hence, if one takes into consi-deration WHO-PCBs, then total WHO-TEQ of all studied sea fish and its products are near or exceed levels established by the EC Council maximum level for fish and fishery products in the Russia (Open Baltic Sea) economic zone (Commission regulation (EC) No 1881/2006; Annex 3).

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Annex 1:

List of Hazardous substances (HELCOM, 2007).

Substances or substance groups of specific concern to the Baltic Sea

1. Dioxins (PCDD), furans (PCDF) & dioxin-like polychlorinated biphenyls
2a. Tributyltin compounds (TBT)
2b. Triphenyltin compounds (TPhT)
3a. Pentabromodiphenyl ether (pentaBDE)
3b. Octabromodiphenyl ether (octaBDE)
3c. Decabromodiphenyl ether (decaBDE)
4a. Perfluorooctane sulfonate (PFOS)
4b. Perfluorooctanoic acid (PFOA)
5. Hexabromocyclododecane (HBCDD)
6a. Nonylphenols (NP)
6b. Nonylphenol ethoxylates (NPE)
7a. Octylphenols (OP)
7b. Octylphenol ethoxylates (OPE)
8a. Short-chain chlorinated paraffins (SCCP or chloroalkanes, C_{10-13})
8b. Medium-chain chlorinated paraffins (MCCP or chloroalkanes, C_{14-17})
9. Endosulfan
10. Mercury
11. Cadmium

Annex 2:

Heavy metals

The following metals are included in EIA: arsenic (As), cadmium (Cd), chromium (Cr), copper (Cu), mercury (Hg), nickel (Ni), lead (Pb) and zinc (Zn). These metals have been selected because some of them are so-called priority substances of the EU Water Framework Directive. Despite some decline in loading, concentrations are 4 to 50 times higher than in the North Atlantic, which could considered here as area with less human influence table 1.

Table 1. Concentrations of dissolved metals (ng/kg) in the North Atlantic and the Baltic Sea and factor of how many times higher the concentration is in the Baltic Sea. The measured concentrations are from the western and central Baltic but provide a general impression of concentrations in the entire project area.

Metal	North Atlantic	Baltic Sea	Factor
Mercury (Hg)	0,15 – 0,3 (Dalziel, 1995)	5 – 6 (Pohl & Hennings, 2005)	~ 20
Cadmium (Cd)	4 (+/-2) (Kremling & Streu, 2001)	12 – 16 (Pohl & Hennings, 2005)	~ 4
Lead (Pb)	7 (+/-2) (Kremling & Streu, 2001)	12 – 20 (Pohl & Hennings, 2005)	~ 3
Copper (Cu)	75 (+/-10) (Pohl et al., 1993)	500 – 700 (Pohl & Hennings, 2005)	~ 10
Zinc (Zn)	10 – 75 (Kremling & Streu, 2001)	600 – 1000 (Pohl & Hennings, 2005)	~ 10 - 50

Table 2. The load of metals (tones) that entered the Baltic Sea sub-regions in 2000 (excluding atmospheric load) (HELCOM, 2004)

	Cadmium (Cd)	Mercury (Hg)	Copper (Cu)	Lead (Pb)	Zinc (Zn)
Gulf of Finland	35	1.2	436	300	277
Baltic Proper	9.7	43	164	70	959
Gulf of Riga	1.5	0.1	43	12	138
Bothnia Bay	2.4	0.4	125	24	609
Bothnia Sea	2.5	0.7	167	38	709
Other Regions	1.9	0.6		33	367
The total Baltic	53	46	1068	477	3059

The quality of sediments in the Gulf of Finland has been classified using the sediment quality classification criteria (SEQC, mg/kg dry weight) for heavy metals employed by the Swedish Environmental Protection Agency (Table 3).

Table 3. Sediment quality classification criteria (SEQC, mg kg-1 dry weight) based on Swedish values (the Swedish Environmental Protection Agency, EPA, Naturvårdsverket 1999).

Metal (mg/kg)	Class 1 Little or nore	Class 2 Slight	Class 3 Significant	Class 4 Large	Class 5 Very large
Pb	<31	31-47	47-68	68-102	>102
Hg	<0.04	0.04-0.10	0.10-0.27	0.27-0.72	>0.72
Cu	<15	15-30	30-60	60-120	>120
Cd	<0.2	0.2-0.5	0.5-1.2	1.2-3	>3.0
Zn	<85	85-125	125-196	196-298	>298
Cr	<80	80-112	112-160	160-224	>224

The Swedish Environmental Protection Agency, EPA, Naturvardsverket 1999, Vallius & Leivuori 2003). According to this classification, the state of surface sediments in the Gulf of Finland was not satisfactory: sediments were "significant" or "largely" polluted with heavy metals (Figure 1). Over the years some of these metal deposits will be transformed into hazardous compounds (incl. organic mercury), so their release back into the marine ecosystem may result in very harmful effects (Perttilä et al., 2006).

Annex 3:

Health risks related to remobilisation of dioxins and associated contaminants

The contamination of environment by hazardous substances such as persistent organochlorine compounds (OCPs) and other persistent organic pollutants (POPs) is a worldwide public health concern (WHO, 2003, Stockholm Convention 2004). The production and use of these compounds is governed by a serious of international conventions, among them the Stockholm Convention and the Persistent Organic Pollutants Protocol of the Convention on Long-Range Transboundary Air Pollution.

Persistent organic pollutants are a group of toxic and persistent chemicals whose effect on human health and on the environment includes dermal toxicity, immunotoxicity, reproductive effects and teratogenicity, endocrine disruption effects, and carcinogenicity (UNEP Chemicals, 2002;WHO, 2003; Kiviranta, 2005). OCPs are acutely toxic, persistent, and bioaccumulative. For that reason, emission quantities do not necessarily have to be very high before the initial effects of accumulations can be seen.

Dioxins cover a group of 75 PCDD congeners and 135 PCDF congeners, of which 17 are of toxicological concern. PCBs are a group of 209 different congeners of which 12 congeners exhibit toxicological properties similar to dioxins and are therefore termed “dioxin-like PCBs” (DL-PCBs). The most toxic congener, 2,3,7,8-tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD), has been classified by the International Agency for Research on Cancer (IARC) as “carcinogenic to humans” on the basis of sufficient evidence from animal and limited evidence from human studies (IARC 1997) and studies in Finland have shown that the largest risks are related to eating the contaminated fish (Verkasalo et al., 2004).

Recently, an increased risk of low birth weights in infants, especially boys, has been associated with a high consumption of contaminated fish from the Baltic Sea by their mothers (Rylander et al., 1995; Agrell et al., 2001). Also, breast cancer incidents were higher than expected in women from the Baltic coast. These women consumed locally caught fatty fish at least twice as often as the control group (Rylander and Hagman 1995; Agrell et al., 2001).

In humans, accidental or occupational exposure to high doses of PCDD/Fs and/or PCBs have caused lesions of skin, chloracne, development defects, and increased the risk of cancer (Kiviranta 2005).

Exposure to PCDD/Fs has been associated with mineralization defects in the first molar teeth, and PCBs are suspected to cause neurobehavioural effects as well as to function as endocrine disrupters (Kiviranta 2005).

The seal material consisted of 14 ringed seals and 6 grey seals that all were found dead and examined for pathology. The main aims were to scrutinize levels and patterns of PCDDs for the first time in seals from the Baltic Sea and to estimate whether chlorinated compounds mentioned have an influence on an exceptional high mortality that occurred among ringed seals in the Gulf of Finland in late 1991 (Koistinen et al., 1997).

1.3 Seabed interventions and of remobilisation of nutrients

According to modelling results provided in the Espoo report seabed intervention will cause release of 12 000 t of phosphorus and 53 000 t of nitrogen into the water column. This is 2,5 % and 0,75 % of the respective annual inputs to the Baltic Sea. HELCOM Baltic Sea Action Plan, adopted and signed by contracting parties in 2008, in the eutrophication segment has the goal to minimise the additional inputs of nutrients. During the implementation of this plan countries are assigned certain nutrient quotas (maximum allowable amounts of inputs). From the presented report it is not clear how this additional amount of nutrient input will be dealt in this context. Other aspect of the same problem is that these estimations are done only on the Baltic Proper segment – so there is still possibility of underestimation of the additional inputs on the local scale. As the most of the intervention works are planned to be carried out in the Gulf of Finland the amount of additional nutrients released during the construction phase have to be assigned to contracting parties bordering this sea area.

2. Impacts Occurring during the Operational Phase

Several relevant impacts that are inevitable during the operational phase are overlooked. If the risks and impacts concerning the construction phase will find an environmentally acceptable solution, the focus should be put to a thorough documentation of baseline situation, taking into the consideration cumulative impacts and initiating well-planned international monitoring programmes where operative long-term cooperation and data input of all parties is guaranteed. They should be worked out by international expert teams. The analysis of the transboundary impact to Estonia is missing in the EIA and should be presented. The following preliminary comments are given on some aspects that were presented.

2.1. Disturbance of traditional fishing patterns

2.2. Damage of fishing gear

Statement on the quality of the report.

1. The spawning and feeding distribution, as well as the dynamics of fish stocks and fish catches statistics, in particular of commercially important marine fish species (cod, sprat, flounder and herring), are assessed at an inadequate level. The fish stocks statistics used in the assessment was based on a too short time period – only two last decades were considered. It means that the deepest stagnation period in the Baltic Sea during last 100 years was taken as a normal situation. Actually, during last 60 years there have been 16 years with high abundances of cod in the Northern Baltic Proper and Gulf of Finland with maximum annual landings of this species much

above 10 000 tons. As the Nord Stream pipe line exploitation time is planned to be at least 50 years, the findings of Espoo EIA Report that the cod is non-common in Gulf of Finland and that the bottom trawling is marginal in this area **are incorrect**.

2. Estonian fishermen are remarkably and efficiently fished for herring and sprat in day-time towing the pelagic trawls in near-bottom position, occurred that the trawl doors and clamps touched the bottom. The free-span pipeline sections over-trawling safety for pelagic trawl in near-bottom position (day-time fishing for herring and sprat) is not estimated and should be addressed.

3. As result, the transboundary impacts on fishery of Estonia are not assessed in Espoo EIA report correctly.

Table of review of the Espoo EIA report (according to EU guidelines for EIA Report review)

SECTION 3. DESCRIPTION OF ENVIRONMENT LIKELY TO BE AFFECTEDBY THE PROJECT				
No.	Review question	Relevant?	Adequately Addessed?	What further information is needed?
	FISH			
1.	Are the fish species diversity, and stocks reproduction areas described an adequate level (Chapter 9, Key Issues: Fish and Fishery)	YES	C	The impact on the Baltic cod and sprat spawning process is not completely assessed and should be upgraded. The periods with higher salinity of Baltic Sea at the time following strong saline water influxes should be taken into account also. During the high abundance periods spawning of cod and sprat is recorded in the Western Gulf of Finland (Bagge, 1981; Grauman, G. B. 1981; Lablaika, 1985; Ojaveer et al., 2003,)
2.	Are the fish feeding areas described in an adequate level (Chapter 9, Key Issues: Fish and Fishery)	YES	B	The impact on cod, sprat and flounder distribution in the Gulf of Finland during the periods of the high abundance of stocks is not assessed and should be addressed. For example the cod remarkably expanded into the Gulf of Finland when abundance is high (Ojaveer et al., 2003)
SECTION 4. DESCRIPTION OF OF THE LIKELY SIGNIFICANT (minor to moderate in Espoo EIA) EFFECTS OF THE PROJECT				
	FISHERY			
1	Are the fish catches amounts by Baltic Are the sea areas and the importance of every separate area for fishery described sufficiently (Key Issues: Fish and Fishery)	Yes	C	The description and evaluation of impact of separate Nord Stream sections on fishery is based on too short time period. The impact assessment should cover the period at least 50 years to be equal e.g. to Nord Stream operation planned period in order to take into account the

				important dependences of fish stock and fishery dynamics on the long term Baltic salinity variations (Ojaveer et. al., 2003; Lablaika, 1985, Drevs and, Järvik, 2002)
2	Are the potential impacts on fishing pattern and technique described completely and adequately (Key Issues: Fish and Fishery)	Yes	C	The free-span pipeline sections over-trawling safety for bottom trawl gear and on pelagic trawl gear towed in near-bottom position (day-time fishing for herring and sprat) is not estimated and should be addressed (Järvik et al., 2005). If the satisfactory solution for the over trawling safety will not be demonstrated in practice then the sea areas closed for trawling and other restrictions for trawling should be established and the corresponding compensation paid to fishing industry of all Baltic countries should be guaranteed.

Recitals

Impacts on Fish and Fisheries

The fish spawning and feeding distribution in the Baltic Sea depend mostly on many peculiarities of environment within the area of habitat and is actually not stable in long-term perspective (Ojaveer et al., 2003, Voipio, 1981, Birjukov, 1969 etc.). One of the most important and variable factors affecting the fish distribution in the Baltic Sea is salinity, especially in the eastern and northern parts of the Baltic Sea. The salinity varies seasonally and is dependent on salt water inflows from the North Sea (Figures 1 and 2) (Astok et al., 1990).

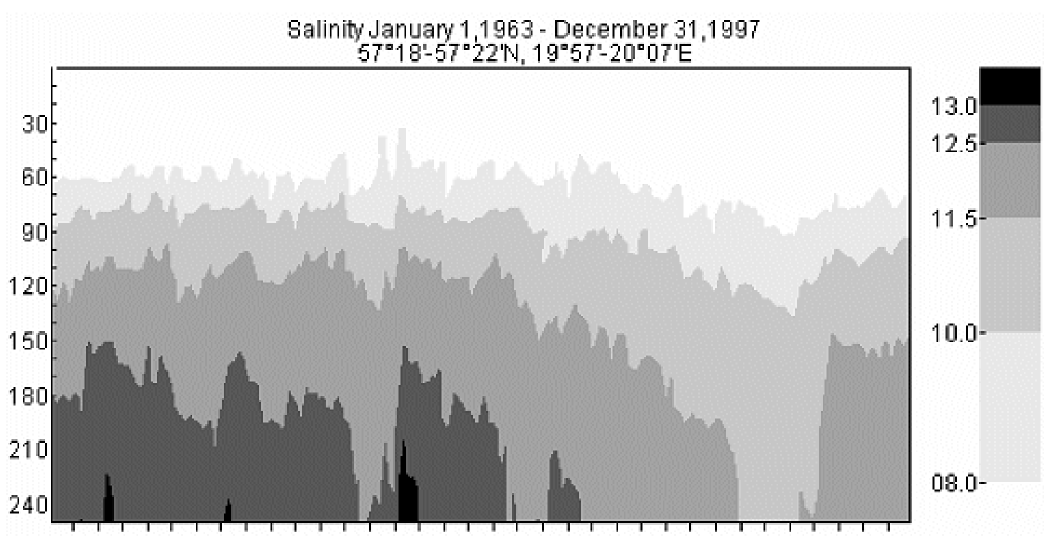

Figure 1. The variablility of salinity in Gotland Deep

www.balticuniv.uu.se/.../ch5/chapter5_g.htm (assessed 07/05/2009)

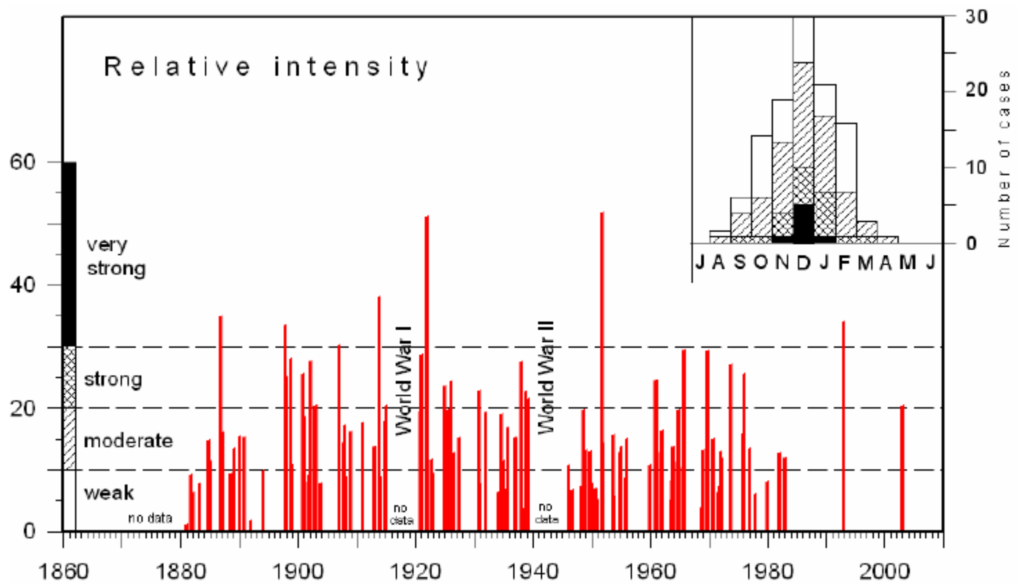

***Figure 2**. Major Baltic inflows (MBIs) between 1880 and 2005 and their seasonal distribution (upper right) shown in terms of their relative intensity (Matthäus and Franck, 1992; Fischer and Matthäus, 1996; supplemented and updated by BACC).*

In particular, the expanding of **cod** to the Gulf of Finland and, as results the cod catches in the Gulf and Northern Baltic Proper are marginal during the period of low salinity. The last strong inflow from the North Sea was observed in 1977, after that the moderate or weak inflows were taken place in some years, but during the most years there were no inflows at all (Figure 2). As a result, since the second half of 1980s the salinity of the water in the northern Baltic Sea dropped significantly. Partly (besides the overfishing) because it, the abundance of cod decreased rapidly in this area and since the end of 1980s the cod abundance in this region of the Baltic Sea has been very low until today (ICES, 2008). However, the probability, that there will be a new strong inflow from the North Sea during the next 50 years (Nord Stream´s planned exploitation time) is not zero. The couple of sequential years without any inflows have been many times during the last century, but not with duration more then 10–15 years (Figure 2).

The moderate and strong inflows of salt water to the Baltic Sea were followed usually by increasing abundance of complete Eastern Baltic cod stock resulted in ascending of the cod landings to the sufficient level within the Northern Baltic, including the Gulf of Finland, with phase of 3–5 years. Figure 3 shows that in Estonian waters (EEZ) the maximum cod landings have taken at the beginning of 1980s, being above 15 000 tons annually. About 50–60% of those have been taken by bottom trawlers fished in the Gulf of Finland (Drevs and Järvik, 2002; Ojaveer, 2003).

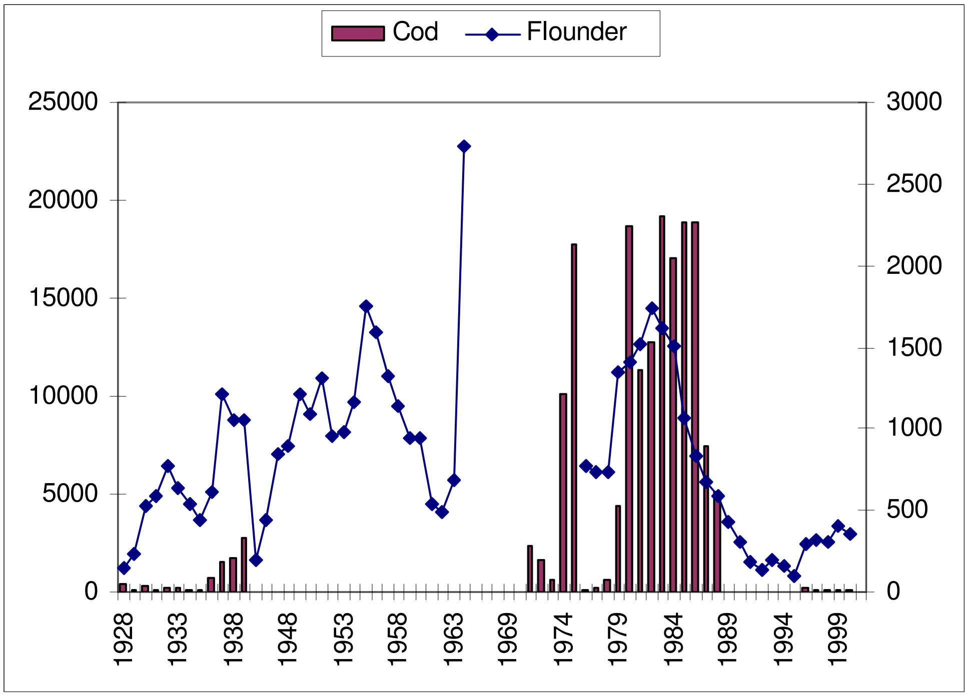

Figure 3. Cod and flounder catches in Estonian waters in 1928-2001 (Drevs and Järvik. 2002).

Furthermore, during the period of higher salinity (above 11 psu at the layer of cod spawning depths) in the northern Baltic and abundance of eastern cod stock, the cod eggs were found even in the western Part of the Gulf of Finland (Bagge, 1981; Mäses, 1985; Ojaveer, 2003).

The other commercially important species, whose spawning and feeding distribution areas strongly depends on salinity, is sprat. The Figure 4 (Figure 9.19. in Espoo EIA Report) described only the spreading of sprat spawning areas specific to deep stagnation period of the Baltic Sea observed recently, unfortunately.

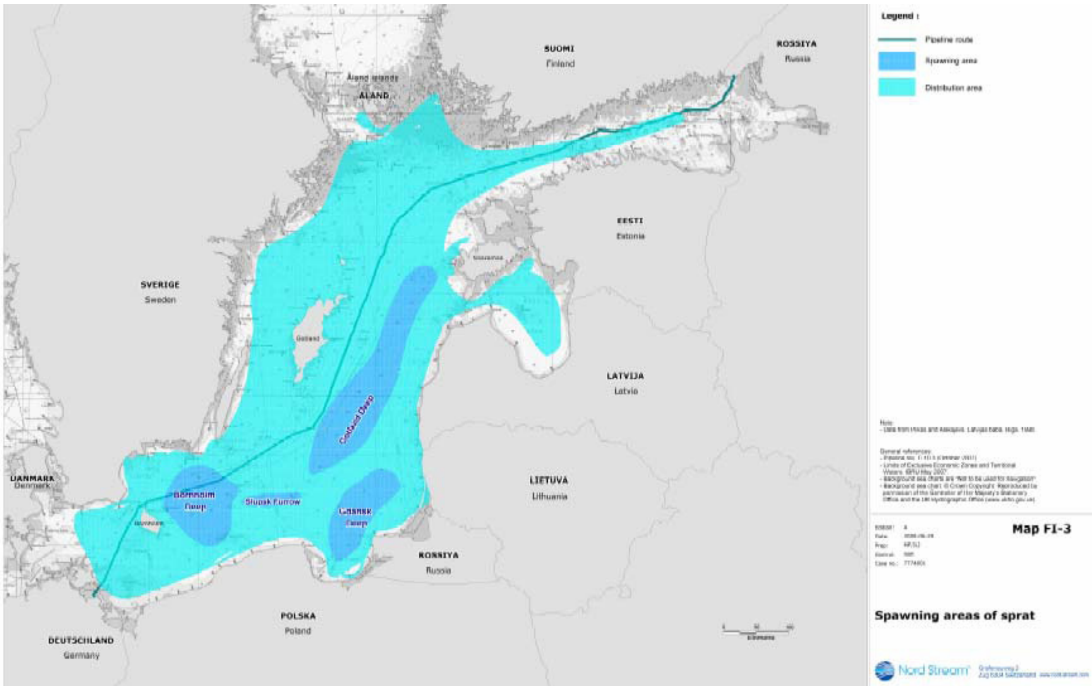

Figure 4. Copy of Figure 9.19 shows the distribution of sprat and the location of spawning grounds in the Baltic Sea., p. 74. Espoo EIA.

In contrast, in the Finnish National EIA it is described in different way, with taking into account a longer period (Figure 5). In this EIA Report it was written (subchapter: 5.4.3.): “Sprat eggs require salinity above 5–6 psu, which limits sprat spawning areas in the Gulf of Finland to the western parts of the gulf.

Figure 5 shows the spawning area of sprat in the Gulf of Finland and subsequently it differs from Figure 4, given in Espoo EIA Report.

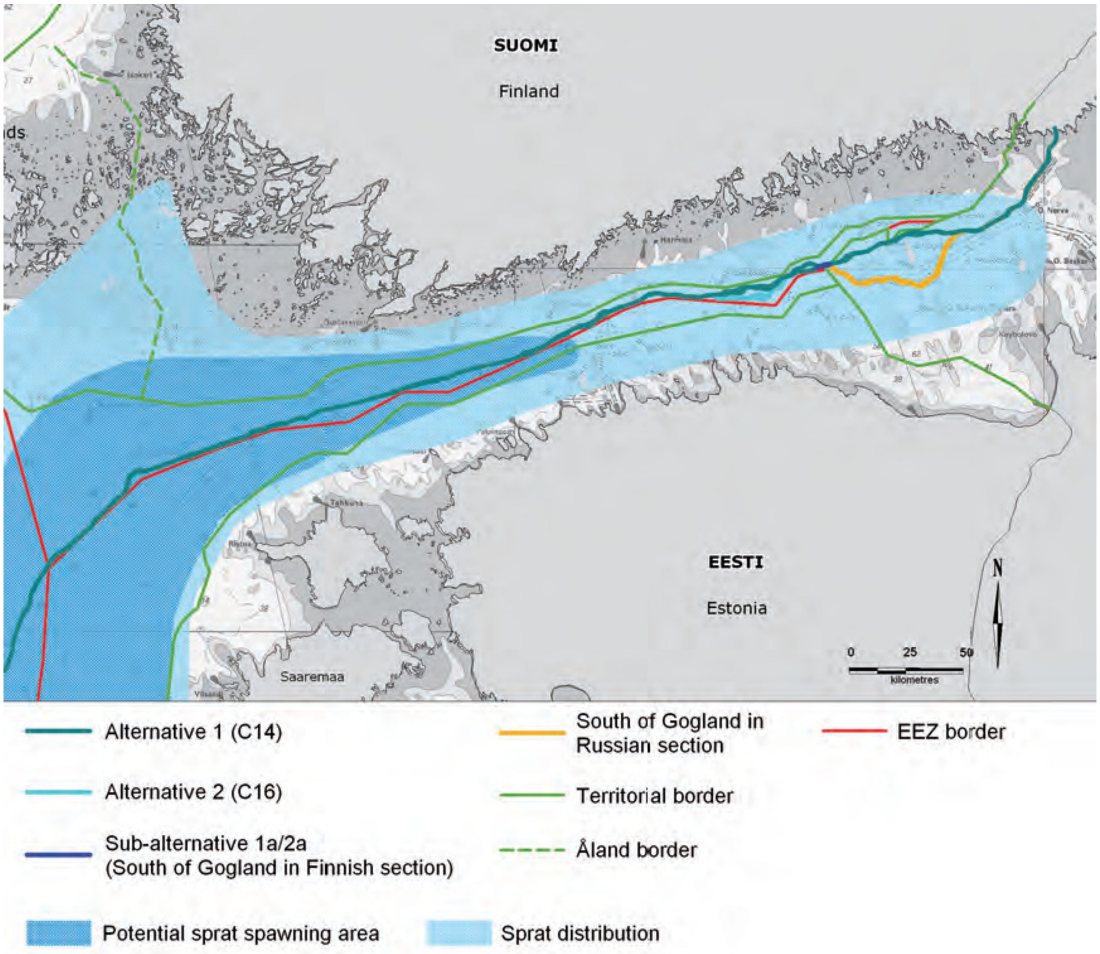

Figure 5. The copy of: Figure 5.54**.** The principal distribution area of sprat in the Gulf of Finland and the northern Baltic Proper. For details, see Atlas Map FI-3-F. Finnish National EIA

Impacts on fishing techniques

In the Espoo EIA Report and in document Key Issues: Fish and Fishery, it was highlighted, that in the Northern Baltic Proper and Gulf of Finland, mainly the mid-water trawls are used and that the Nord Stream pipe line will not cause any restrictions for this fishing during the operation period. However, it ignores the the fact, that Estonian fishermen usually are fishing for herring and sprat in day-time in nearby sea bottom, in which connection the trawls doors and clamps touched during almost all trawling the bottom (Järvik et al., 2005). The using of the mentioned fishing technique in the area close to pipe line may be more unsafe them over trawling the pipe line with bottom trawls because of the clamps. As this problem was not evaluated in the Espoo Report or in any National EIA Reports, it remains still open and needs special investigations. Of course, there will be possible to lift the pelagic trawls for the tome overtrawling, but it will cause economical and fishing time losses for fishermen. If the last solution will be only possible, the compensatory measures should be assessed.

Impacts on traditional fishing pattern in the Northern Baltic Proper and Gulf of Finland

In aspect of evaluation the potential impacts on fishing pattern within the Northern Baltic Proper and Gulf of Finland in the Espoo EIA Report the year 2005 was taken as the baseline. Unfortunately, the year 2005 showed very low level of herring landings of Estonian fishing fleet in the area of interest. Furthermore, the herring stock condition in ICES SD-s 25-32 was low (ICES, 2008), as a result of low national quotas for Estonian fishermen. Since 2005 the TAC (total allowable catch) of this herring management unit has been increased that has resulted in increasing annual landings of herring,. Additionally, as herring and sprat fished are often as mixed fishing, the landings of sprat were also increased. So, in 2007 Estonian landings of herring and sprat in the Gulf of Finland were 8603 and 27676 tons and reached in 2008 11900 and 27333 tons, respectively. The historical highest catches of Estonian fishermen in the Gulf of Finland have been above 20 000 tons.

Also, the distribution of herring and sprat catches by ICES Rectangles have been different from year to year. In Figure 6 it is given for the year 2007.

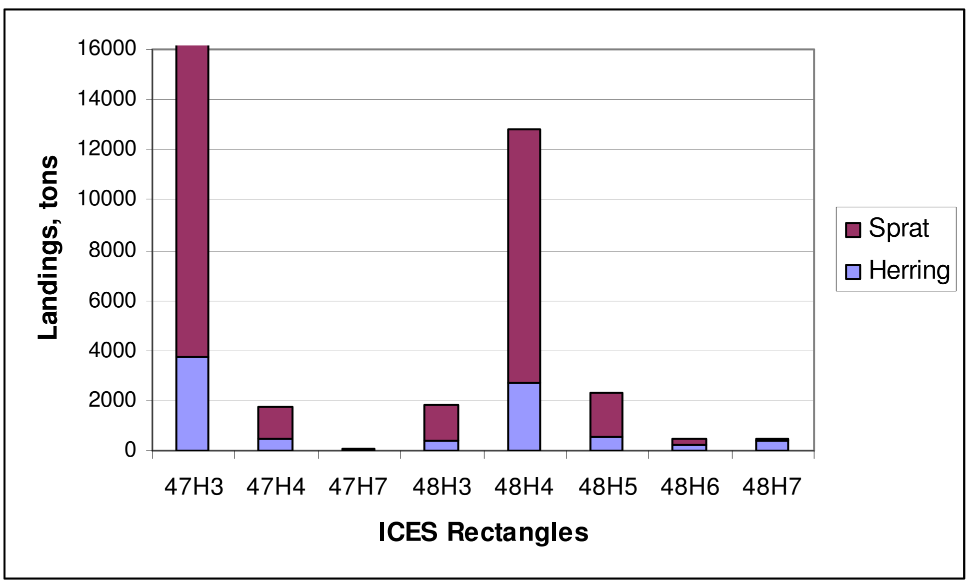

Figure 6. The annual catches distribution of herring and sprat by Estonian fishing fleet in the Gulf of Finland in 2007 (Sapronova, 2009).

Conclusions

The above short description of the distribution and abundance of commercially very important fish species in the northern Baltic, cod and sprat from the point of view of long-term perspectives gives somewhat (in some cases, significantly) different picture, as compared to the materials presented in the Espoo EIA Report of Nord Stream pipe line. It should be pointed out, that due to differences, mentioned above, there may be significant discounts in possible impacts on fish stocks and fishery in the Estonian EEZ, also.

The relatively short database of fishery statistic used in the Espoo EIA Report for description of fishing situation does not give the adequate picture about the fishery in the Northern Baltic and Gulf of Finland in longer perspective resulted in losses of some Nord Stream pipe line possible impacts.

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3. Impacts as a Result of Unplanned Events

In many cases, it is not clear from the Espoo EIA, what kind of changes in the technical project have been made or planned that are not in accordance with the EIA. As a result, several unplanned events are not included to the environmental impact assessment.

It is not clear, what is the actual pressure in the beginning of the pipeline in the Vyborg area, because the pressure of 220 Pa was planned for the project that included the service platform near Gotland. It is not explained in the EIA, whether it would be possible to operate the pipeline with the same pressure or higher pressure and what are the risks of either of these solutions.

After submission of the report, it was claimed in the public presentation that instead of the anchored installation, a floating laybarge will be used for the pipeline installation in most of the Gulf of Finland. There is no environmental impact assessment on the risk of this activity and the additional air pollution and eventual water pollution.

Risks resulting from exploding of munitions and eventual leaks of chemical munitions are not sufficiently evaluated and the locations of the conventional and chemical munitions are not reported. The lack of information on explosive and toxic substances is a high risk. Before any permitting procedures, the detailed locations of conventional and chemical munitions in the Baltic Sea should be investigated and the results made available to all parties.

3.2. Disturbance of conventional and toxic munitions

Statement on the quality of the report

The expected long-distance transboundary impacts of accidents with toxic munitions near Bornholm and elsewhere are mentioned in the statements of the Espoo EIA, but not analysed. The information provided on toxic munitions and the conclusion about associated minor risks are not in balance, taking into the consideration that the exact locations of the toxic munitions dumping places are not provided. The information about the dumped Hg barrels in the Baltic Proper is insufficient.

The statement that the munitions clearance in the Russian EEZ has “minor impact” to Estonia is not supported by any evidence, because the information on the conventional munitions in the Russian EEZ is missing. The assumption on “minor impact” is made *before* the study of munitions, that, according to the official report of Ramboll from October 2007, is planned for summer-autumn, 2009. Also, the information on the eventual toxic munitions in the Russian EEZ is missing.

Potential accidents with toxic and conventional munitions are related to the highest risks and to environmental hazards and should be included to the EIA report. Without completing and reporting the above aspects, the EIA process is incomplete.

It should be emphasised that within the context of the Espoo Convention and EU EIA directive, planning of any conventional munitions clearance to be carried out by any country should be reported in good time with thorough evaluation of transboundary impacts.

Special concerns related to chemical munitions.

1. Not all dumping places of chemical weapons could be known in the Baltic Sea, especially in the Gulf of Finland.
2. No data about the Russian zone are available.
3. Chemical weapons lying deep in the mud (more as 1 m) could not been discovered.
4. The extent of poisoning by a chemical weapon accident is not estimated.

3.3. Pipeline failure

The risk assessment made in the ESPOO EIA report underestimates as the frequency of pipeline failure as well the rates of human and environmental losses in orders, risk factor lies deep in the unacceptable area of F-N curve.

This pipeline looks like a super bomb lying in the sea bed with a 1200 km long permanent detonator. Thousands of people (crews of vessels) can make the fatal mistake in every minute.

SECTION 3. DESCRIPTION OF ENVIRONMENT LIKELY TO BE AFFECTEDBY THE PROJECT				
No.	Review question	Relevant?	Adequately Addressed?	What further information is needed?
	Risks of assidents and hazards			
1.49	Are any risks associated with the Project discussed? - risks from handling of hazardous materials - risks from spills fire, explosion - risks of traffic accidents - risks from breakdown or failure of processes or facilities - risks from exposure of the Project to natural disasters (earthquake, flood, landslip, etc.)	**Yes**	**D**	Some risks are discussed, but mostly it is based on false premises, due to the use of out-of-date or irrelevant sourtces of information. The earth quake risks are believed to be low, based on a 1994 school text-book, while the recent Kaliningrad earth quake in 2004 and the following publications re-evaluated the seismic risks for the Baltic Sea. Risks related to conventional and chemical munitions are underestimated and poorly defined because the unwillingness to provide precise location information. Breakdown risks are underestimated, because the pressure in the pipe will be likely higher than described in the initial version of the project. No new information has been made available.
	risks from handling of hazardous materials	Yes	E	There are no data about the Russian zone, but the elimination of munitions in the zone in June and July 2009 is planned.
	risks from spills fire, explosion	No	E	No modeling of the gas cloud explosion is available. The data about the fatalities in this explosion are underestimated by 1–2 orders of magnitude (10 -100 times). Environmental damage of the explosion has not been estimated at all.
	risks of traffic accidents	Yes	E	Risks related to ship traffic accidents are underestimated, because it has not been taken to account, that many ship routes go parallel to the pipelines.
	risks from breakdown or failure of processes or facilities	Yes	E	It is not clear where EIA the statistics about the dragging anchors, dropped anchors and other objects is adequate for the Gulf of Finland conditions. Frequency of dragging anchors appears to be underestimated. It is not clear on what basis the transformation of frequency dragging and dropped objects to the frequency of the pipeline rupture is made.
	risks from exposure of the Project to natural disasters (earthquake, flood, landslip, etc	Yes	C	The hazard from storms and wakes is discussed very superficially. The rose of winds (Fig. 5.6) is inadequate for the Baltic Sea, for example 24 m/s wind occurs some times in year, not once in 10 years, frequency of 27 m/s is much higher as once in the 100 years.
1.50	Are measures to prevent and respond to accidents and abnormal events described? (preventive measures, training, contingency plans, emergency plans, etc	Yes	C	The questions are: How can the signal about the gas leakage arrive at the land station in three minutes (that is, faster than the speed of sound in the gas) And how it is possible the remote sensing of the pipeline route in the cloudy sky conditions or in rough windseas, or under ice cover
				Section 2. Consideration of Alternatives
2.1.	Is the process by which the Project was developed described and are	Yes	D	The project development is described, but environmentally sound alternatives are not discussed in sufficient detail.

	alternatives considered during this process described? (for assistance, see the guidance on types of alternatives which may be relevant in Part B3 of the Scoping Guide in this series)			
2.2.	Is the baseline situation in the No Project situation described?	Yes	E	The information of the present status of a large area (Russian EEZ) and on many issues (locatrion ofd munitions) is missing.
2.3.	Are the alternatives realistic and genuine alternatives to the Project?	Yes	E	Several overland alternatives recommended by affected parties have been ignored by the project developer without a sound argument from the environmental perspective.
2.4.	Are the main reasons for choice of the proposed Project explained, including any environmental reasons for the choice?	No	E	The environmental reasons of the choice are misrepresented. As compared to the overland alternatives, the undersea pipeline is decribed as more environment-friendly in the context of the climate changes. The near-catastrophic ecological situation of the Baltic Sea and related pressures from the seabed intervention for any large installation are ignored.
2.5.	Are the main environmental effects of the alternatives compared with those of the proposed Project?	Yes	E	The comparison of the environmental effects of the overland alternatives is missing. The environmental effects of the underwater alternative are underestimated.

Recitals

The potential extent of risk.

Diameter of the pipe – 1.153 m, length – $1220*10^3$ m, pressure (mean) – 160 at, special firing energy of the gas – 39 MJ/m^3 (at 1 atm pressure), explosion equivalent – 1 kg TNT = 4 MJ/kg TNT, power of the Hiroshima bomb (HB) – 15 000 000 kg of TNT, velocity of gas in the pipe – 4 m/s.

The total energy in the pipe is 8×10^9 MJ (133 HB). In the worst case (breakup of the pipeline) 80 000 m3 of gas flows out in one minute. That means it takes about 20 minutes to form an explosive cloud comparable to a nuclear bomb.

Is such a catastrophe possible?

Nord Stream insists that the possibility of the pipeline breakup is very low (10^{-5} – 10^{-4} y^{-1}) and less than 10 people would die in the accident. These results remain unsubstantiated.

The Baltic Sea belongs to the seas with the most intensive ship traffic in the world (figure 1).

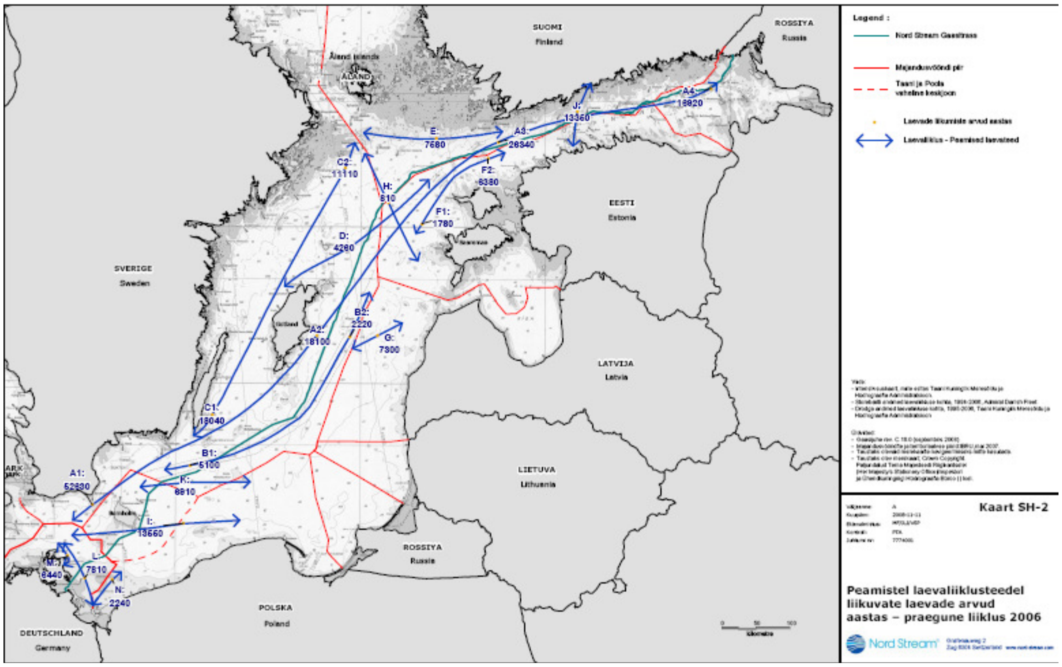

Figure 1. Number of ships on the main ship lanes in 2006.

Only in three areas in Europe the ship traffic is more intensive: in English Channel, Denmark Straits and near the coast between Rotterdam and Hamburg.

The route of the pipeline largely coincides with ship lanes within 766 km (figure 2).

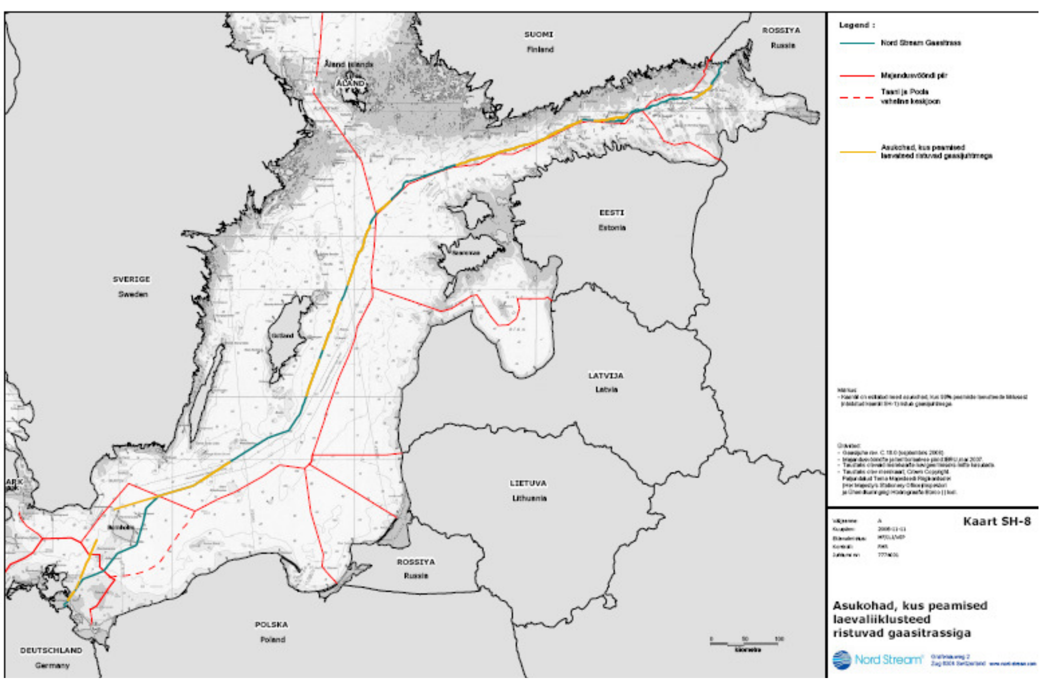

Figure 2. Crossing of main ship lanes with the pipeline.

Table 1 shows the intensity of ship traffic in the distinctive sections of the pipeline.

Table 1. Ship traffic intensity on the pipeline rout by figures 1 and 2.

Coinciding sections of the pipline and ship lanes	Length km	Ships in 2006	Ships in 2016	Ships*km 2016
Gulf of Finland (Russia - Finland)	40	16920	17430	$0.7*10^6$
Gulf of Finland (Finland - Estonia)	285	16920	17430	$5.0*10^6$
Tallinn-Helsinki (Finland – Estonia)	0.5	13350	13380	$0.007*10^6$
Baltic Proper (Sweden – Estonia, Latvia, Poland).	400	26350	27400	$11*10^6$
Near Bornholm (Denmark – Poland, Germany)	0.5	13550	13910	$0.007*10^6$
Greifswald (Germany- Denmark, Poland)	40	7810	7860	$0.3*10^6$
All together	**766**	**94900**	**97410**	**$17.0*10^6$**

Lower values are reported in Chapter 5 of NS Espoo report (risk assessment), table 2.

Table 2. Ship traffic intensity on the pipeline rout by chapter 5.

State	Section	Along, km	Ships	Ship*km,	% of total operation risk
Gulf of Finland (Russia and Finland)	**1**	**10**	**189**	**1890**	**0.033**
Gulf of Finland (Russia and Finland)	**2**	**12**	**2042**	**24504**	**0.434**
All Russia				26394	0.467
Gulf of Finland (Estonia and Finland)	**1**	**70**	**41493**	**2904510**	**51.385**
Gulf of Finland (Estonia and Finland)	**2**	**31**	**26056**	**807736**	**14.290**
Gulf of Finland (Estonia and Finland)	**3**	**34**	**23745**	**807330**	**14.283**
Gulf of Finland (Estonia and Finland)	**4**	**18**	**4033**	**72594**	**1.284**
Gulf of Finland (Estonia and Finland)	**5**	**10**	**1590**	**15900**	**0.281**
Gulf of Finland (Estonia and Finland)	**6**	**10**	**1474**	**14740**	**0.261**
Gulf of Finland (Estonia and Finland)	**7**	**21**	**14634**	**307314**	**5.437**
All Finland and Estonia				4930124	87.222
Baltic Proper (Sweden, Latvia, Lithuania, Poland)	**1**	**26**	**4573**	**118898**	**2.103**
Baltic Proper (Sweden, Latvia, Lithuania, Poland)	**2**	**10**	**822**	**8220**	**0.145**
Baltic Proper (Sweden, Latvia, Lithuania, Poland)	**3**	**12**	**6691**	**80292**	**1.420**
Baltic Proper (Sweden, Latvia, Lithuania, Poland)	**4**	**18**	**7523**	**135414**	**2.396**
Baltic Proper (Sweden, Latvia, Lithuania, Poland)	**5**	**20**	**4672**	**93440**	**1.653**
Baltic Proper (Sweden, Latvia, Lithuania, Poland)	**6**	**10**	**2176**	**21760**	**0.385**
Baltic Proper (Sweden, Latvia, Lithuania, Poland)	**7**	**10**	**1646**	**16460**	**0.291**
All Sweden				474484	8.394
Denmark	**1**	**10**	**1991**	**19910**	**0.352**
Denmark	**2**	**15**	**4115**	**61725**	**1.092**
Denmark	**3**	**10**	**1681**	**16810**	**0.297**
All Denmark				98445	1.742
Germany		**10**	**3321**	**33210**	**0.588**
Germany		**10**	**5625**	**56250**	**0.995**
Germany		**10**	**3350**	**33500**	**0.593**
All Germany				122960	2.175
All Baltic				$5.65*10^6$	100

It is not known, which data are most reliable, but it is evident, that the vessels are going millions of kilometers per year above the pipeline, and this is the most important factor for the pipeline damage. About **87% of the risk is concentrated on the EEZ border between Finland and Estonia, that means Finland and Estonia are taking most of operational risks of the pipeline.**

Could a serious accident happen?

About 50 accidents could be listed on the Nord-Stream route during 19 years (figure 3).

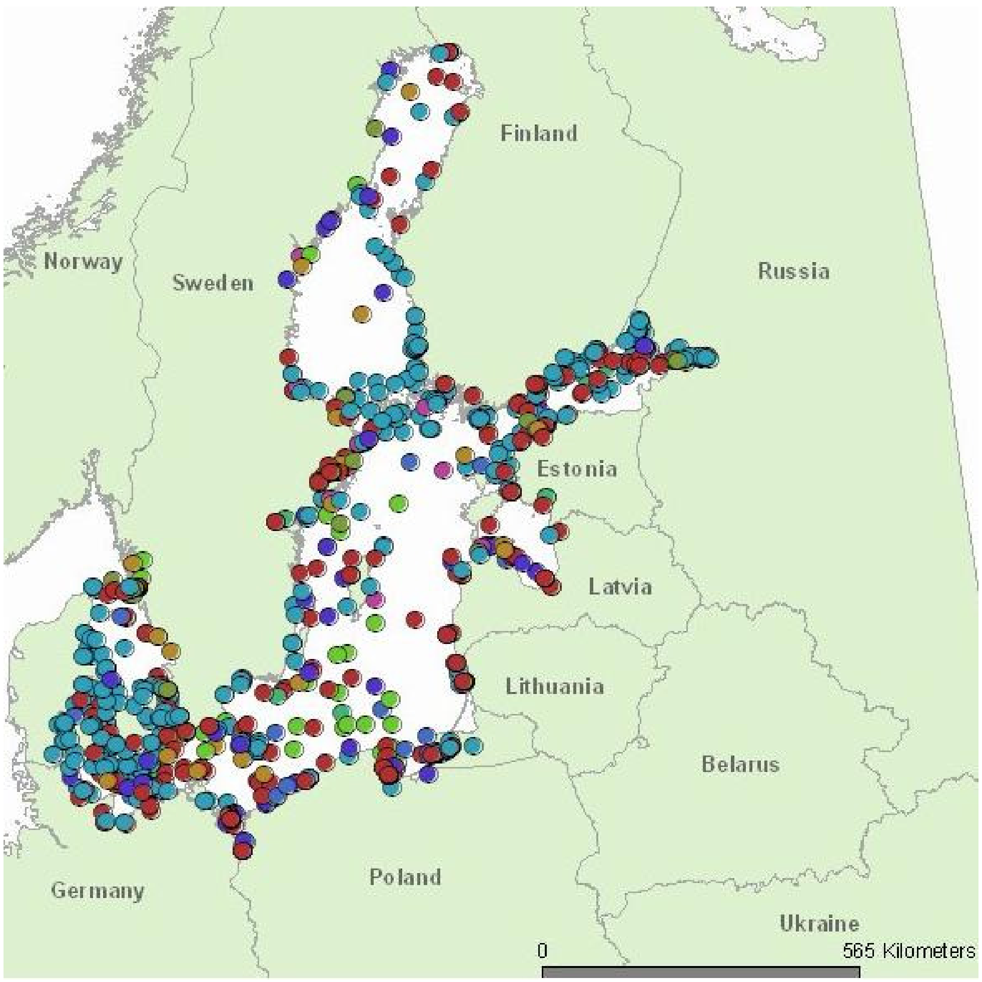

Figure 3. Shipping accidents 1989-2007
(http://62.236.121.189:81/website/MARIS/viewer.htm)

Main types of the accidents (2000–2005) were grounding (47%) and collisions (28%; figure 4).

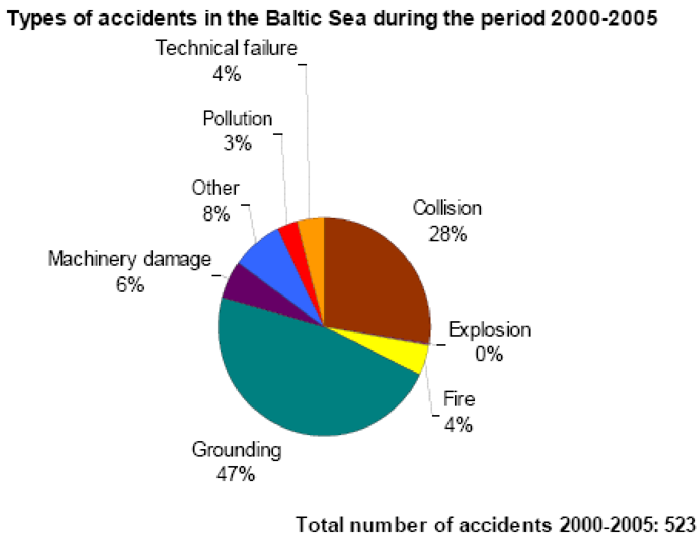

Figure 4. Types of accidents in the Baltic Sea.

Main causes of accidents were human factor (42%) and technical factor (23%; figure 5).

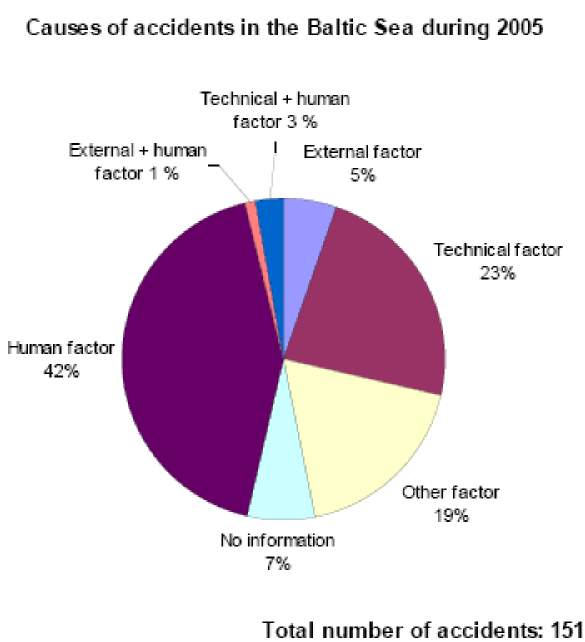

Figure 5. Causes of accidents in the Baltic Sea.

Of course, not every accident will cause damage to the pipeline. It is important to note that several events are not registered in official statistics, for example,dragging anchoring. Let us assume that the number of dragging events is equal to the ship accidents. This means a serious danger for the pipeline happens 1.3 times per year (k = 50/19/2, divided with 2 because only anchoring of "upwind" ships could damage the pipe).

Could the gas cloud explode?

Considering the traffic intensity in the Gulf of Finland ,41 490 vessels pass the ship lane above the pipeline yearly. That means (if we assume a mean speed of a vessel being 15 km/h) through any point in the line go 4.7 vessels in an hour, or the distance between two neighbour vessels is 1/4.7*15 = 3.2 km, or it takes 3.2/26.4*60 = 6.4 minutes if a vessel enter into the cloud.

Even if it is true that the gas release will be registered in the inflow station after three minutes (which is highly unlikely, as the sound speed or methane pressure wave speed is only 430 m/s), the alert time will be too short to avoid the catastrophe.

What is the frequency of a pipeline failure?

Assuming that only one of the 100 dragging accidents will cause a rupture of the pipe, the probability is $1.3*10^{-2}*y^{-1}$. Taking into account that the number of victims (dying) is between 10 (crew of a cargo ship) and 10^4 (up to 2000 passengers on the board only of one ship) it is clearly seen that the risk by the F-N curve (Fig. 5-2) is lying deep in the unacceptable area.

And we have not taken into account here, that an explosion comparable to a nuclear bomb could cause major consequences on the shore too as by the shockwave as well by the initiated tsunami-like sea waves. Also the possibility of a terrorist action has not been discussed.

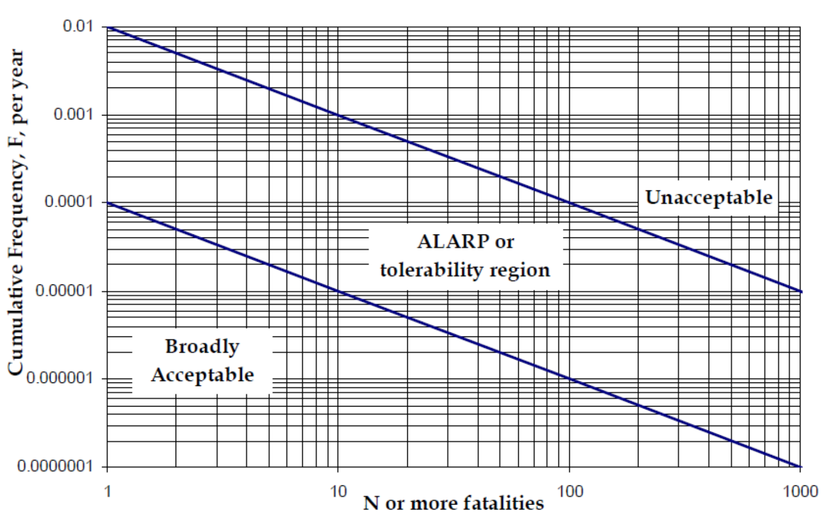

Figure 5.2 **Example F-N curve**

The same holds for the risk matrix for the environmental risks, as the restoration time of the gas explosion consequences is more as 10 years in the fact.

Consequences			Probability (increasing probability →)			
Descriptive	**People**	**Environment**	**Remote** (< 10^{-5}/y)	**Unlikely** (10^{-5} - 10^{-3} /y)	**Likely** (10^{-3} - 10^{-2} /y)	**Frequent** (10^{-2} - 10^{-1} /y)
1 Extensive	Fatalities	Global or national effect. Restoration time > 10 year	**A1**	**B1**	**C1**	**D1**
2 Severe	Major Injury	Restoration time > 1 yr. Restoration cost > USD 1 mil.	**A2**	**B2**	**C2**	**D2**
3 Moderate	Minor Injury	Restoration time > 1 month. Restoration cost > USD 1 K	**A3**	**B3**	**C3**	**D3**
4 Minor	Illness or Slight Injury	Restoration time < 1 month. Restoration cost < USD 1 K	**A4**	**B4**	**C4**	**D4**
HIGH	The risk is considered intolerable so that safeguards (to reduce the expected occurrence frequency and/or the consequences severity) must be implemented to achieve an acceptable level of risk; the Project should not be considered feasible without successful implementation of safeguards					
MEDIUM	The risk should be reduced if possible, unless the cost of implementation is disproportionate to the effect of the possible safeguards					
LOW	The risk is considered tolerable and no further actions are required					

Figure 5.3 Risk Matrix & Associated Tolerability Criteria

Main conclusions

The risk assessment made in the ESPOO report severely underestimates as the frequency of pipeline failure, as well as the rates of human and environmental losses, the magnitude of the error apparently being several orders (10–100 times), risk factor lies deep in the unacceptable area of F-N curve. In case of an accident, this pipeline can turn into a super bomb lying in the sea bed with a 1200 km long permanent detonator. The loss of lives in case of a major rupture may reach thousands of people onboard of vessels.

4. Gaps and uncertainties

Some of the gaps are related to the scoping process that is partly incorrect in the context of the EIA directive. Most relevant aspects here are the failure to analyse the overland alternatives in the EIA process and the failure to include the processes related to the production cycle of the gas pipe, including the pipe coating and construction factories in Mukran, the island of Bornholm, Germany, Kotka in Finland and elsewhere. According to the EU EIA directive guidelines, on which the Espoo EIA in the EU is based, these raw material production processes should be included to the process of EIA.

4.1. Gaps and uncertainties described by the developer

In the Espoo EIA, the developer has listed the following gaps in baseline information:
The pertinent gaps in baseline information which would primarily influence the assessment of resource or receptor sensitivity are the following:

- Limited catch data and fish pattern for fishing vessels of less than 10 metres
- Limited data on natural ranges of suspended matter, hydrogen sulphide and oxygen in the water column near the seabed along the length of the pipeline
- Limited understanding of the natural variability and trends in population size and the spatial and temporal distribution of species of interest. Long-term ecological data are needed for the study of biological systems over seasonal and annual time frames but these are typically lacking.

The following are the most pertinent gaps in understanding the scale, duration and intensity of impacts:

- Gaps in data on the ability of the Baltic Sea fisheries to adapt their fishing patterns in response to the obstacle associated with the long term presence of the two pipelines on (or near) the seabed
- Limited understanding of the impacts on different receptors of munitions clearance. Specific gaps include pulse propagation, scale and intensity and the duration, scale and intensity of suspended matter in the water column
- Impacts of underwater and airborne noise levels or dredge plumes on fish, marine mammals and birds; e.g. the zone of influence in which birds will exhibit “startle behaviour” is not known for all species in the ESRs
- The period of time necessary for benthic communities to recover from different impacts
- The multiplicity of factors that makes it difficult to assess both the relative impact of any single factor, anthropogenic or natural, to the dynamics of the ecosystem

- The cumulative impacts of the pipelines with developments such as wind farms, new cables for telecommunications and the extraction of minerals in the Baltic Sea
- Inherent limitations of models (e.g. sediment spreading, nutrient and contaminant release, and oil spill modelling) to accurately predict the magnitude and extent of impacts

4.2. Gaps and uncertainties not described by developer

4.2.1a. Water exchange

Statement on the quality of the report

According to the EIA report "**no impacts** to physical processes in the Baltic Sea are anticipated as a result of the physical presence of the pipelines on the seabed" (Espoo EIA Report, page 1416). Accordingly, in Chapter 11 (Transboundary impacts) of Espoo EIA Report the potential impacts to the physical processes and the related impacts to the water column and plankton are totally ignored. On the other hand, it is evident that the presence of pipelines will affect the near-bottom currents and consequently also the Baltic Sea deep water renewal and water exchange between different sub-basins, for instance, between the northern and central-southern areas of the Gulf of Finland. Therefore the environmental impact assessment has to give an answer what could be the extent of this impact. According to the EIA Espoo Report it is not done in a reproducible way and no data on near-bottom currents used can be found.

In the report. a reference is made to an incomplete study "conducted to estimate the extent of the potential impact from the presence of the pipelines on the salinity, volume flow and oxygen concentration of new deepwater in the Bornholm Basin" (page 1072). Since the study is not completed and not accessible it is hard to understand how the following conclusion is derived "if the Nord Stream pipelines extend to 1.5 m above the seabed, pipeline presence could dissipate about 0.5% of the total potential energy of the currents, depending on the speed of the dense bottom current in the crossing section. However, the study found this to have little or no impact on the existing current patterns." The latter is in contradiction with a very rough estimate if comparing pipeline height and the thickness of near-bottom flow. On the basis of published measurement results[9,10] the layer occupied by the bottom currents in the area of interest is only 10–20 meters above the seabed and the layer affected by the pipelines is about 10% of it.

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[9] Sellschopp, J. et al., 2006. Direct observations of a medium intensity inflow into the Baltic Sea, Cont. Shelf Res., 26, 2393–2414.

[10] Meier, M. et al., 2006. Ventilation of the Baltic Sea deep water: A brief review of present knowledge from observations and models. Oceanologia, 48S, 133–164, and references therein.

The bottom sediments are a major source of phosphorus in the Gulf of Finland. Release of phosphorus from the sediments occurs under anoxic/hypoxic conditions near the seabed. If the water exchange between deeper areas of the gulf is restricted then anoxic/hypoxic conditions may appear more frequently (or their duration could increase). The report contains some improper statements in regard of impacts the pipelines to physical processes (page 990), such as “the pipelines in ESR II are located in the main outflow area outside the Finnish coastal area, where outflow is quite homogenous from the surface layers down to the depths of 30 m and has a typical speed of 2–5 cm/s. At the seabed, where the pipelines will be located and will measure 1.5 m in height, there is a high number of eddies present due to the influence of the bathymetry. It is therefore unlikely that the presence of the pipelines will cause any significant changes to the deepwater current system, given the turbulence already caused by the existing eddying effects.” Instead, a study has to be carried out to assess whether the seabed intervention works (rock placement) would create more artificial closed deeper areas or not and what is the extent of impacts to the water column and plankton.

In conclusion, the potential impacts of the presence of pipelines to the deep water circulation, both, in the Baltic Sea scale as well as in smaller sub-basin scales in the Gulf of Finland have to be assessed. Measurement data, both available data and specific new data collected by conducting near-bottom current measurements, have to be taken into account.

4.2.1b. Missing information on near-bottom flows that control spreading of sediments and released substances

Many of the pipeline-related activities (munitions clearance, seabed intervention works, dredging, pipe laying) affect environment (water column, plankton, marine benthos, fish, nature conservation areas) through dislocation of sediments, increase of turbidity and release of hazardous substances. The extent of spreading and released concentrations was assessed based on the modeling method. The used model is acceptable in general terms, but requires calibration and validation by observational data in each individual case. For the Nord Stream pipeline, model performance to simulate near-bottom currents is critical factor in qualifying the results of calculations into impact assessment scale categories as local, regional and national scale impact and intensity categories. The model validation is especially important in the Gulf of Finland and Northern Baltic Proper where bottom relief is very rough compared to the other Baltic Sea regions[11]. We consider imperative to use <u>best available technology for the assessment of sediment spreading</u>. Observations of near-bottom current must be done in the amount that allows firm calibration and validation of the model in the specific conditions of the EIA.

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[11] Nord Stream Espoo Report: Key Issue Paper. Seabed Intervention: Works and Anchor Handling, Figure 2.3, p.11.

In the list of survey activities, investigation of near-bottom currents that control spreading of dislocated sediments and substances, accumulated formerly in sediments, is missing.

The summary statement "Information on current velocities and water levels is acquired from readily available hydrodynamic models that have been calibrated over decades and take into account the corresponding meteorological changes."[12] is in contradiction with the more detailed report on the used modelling techniques in the Gulf of Finland "The validation of the MIKE 3 HD flow model is based on a very small amount of measuring observations, and the seabed currents were validated in the main basin of the Baltic Sea only. Local benthic currents occupy a significant role in calculating the spreading of turbidity caused by aquatic works."[13]

4.2.1c. Missing information on the impact of the field of internal waves on the pipeline and the surrounding sediment

The potential impact of the vertical stratification of water masses to the dynamics of water motions has been recognized a long time ago. It is well known that in the case with stratification the velocities near the underlying surface may be strongly intensified compared to the homogeneous case[14] and it is customary to study the related effects in the planning phase of underwater pipelines[15].

One of the basic agents of hydrodynamic activity in stratified seas are internal waves. Their impact on sea bottom and on the pipeline is dynamically similar to that of the surface waves. The most intense internal waves are usually found to exist at depths where the largest changes of water density occur. A major feature of the hydrography of the Gulf of Finland is the quasi-permanent halocline (at times evolving to a system of different jump layers) separating the upper, relatively well-mixed, warmer and fresher water from the near-bottom, more saline and usually colder water[16]. The presence of this feature gives rise to a multi-layer structure of the water masses during a large part of the year. In the eastern part of the Gulf of Finland the permanent halocline may be missing, but the thermocline still gives rise to a two-layer structure.

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[12]Nord Stream Espoo Report: Key Issue Paper. Seabed Intervention: Works and Anchor Handling, p.38

[13] Natural gas pipeline through the Baltic Sea. Environmental impact assessment in the exclusive economic zone of Finland. APPENDIX XI: Report on the Water Quality Modelling of the Nord Stream Gas Pipeline. Author: Luode Consulting Ltd, p. 8.

[14] Baines, P. 1995. Topograpic effects in stratified flows. Cambridge University Press.

[15] Berntsen, J., Furnes, G. 2002. Small scale topographic effects on the near sea bed flow at Ormen Lange. Report No 171. Department of Mathematics, University of Bergen, 34 pp.

[16] Alenius, P., Myrberg, K., Nekrasov A. 1998. Physical oceanography of the Gulf of Finland: a review. *Boreal Env. Res*. 3: 97–125

The typical depth of the halocline (60–80 m) in the western Gulf of Finland roughly coincides with the depth of planned pipeline and thus it may frequently be impacted by internal waves excited in the Baltic Proper. Owing to large variations of the halocline position and potential events of almost total exporting of the more saline water out of the Gulf of Finland[17] virtually the entire section of the pipeline in the Gulf of Finland may be subject to direct impact of the halocline-bound or thermocline-bound internal wave activity. The analysis of the potential consequences to the pipeline (scour, inhomogeneous sinking, remobilization of bottom sediments and nutrients due to accompanying local intensification of hydrodynamic processes, etc.) is completely missing.

4.2.1d. Anisotropic transport patterns in the Gulf of Finland

The classical overall circulation scheme of the Baltic Sea is that the water masses perform a slow cyclonic motion in the Baltic Proper and in the largest subbasins. Eddy-resolving simulations of the Gulf of Finland circulation[18] revealed an intuitively obvious fact that the generally discernible cyclonic circulation overlaps with numerous quasi-permanent mesoscale features (eddies, fronts and local jets) and possesses a nontrivial vertical structure. On top of that, there exists a specific structure of the circulation patterns of the Gulf of Finland that becomes evident in the form of strongly anisotropic pollution transport patterns in this area[19]. The experience with two relatively large-scale pollution events in 2006 and current simulations of the transport of pollution released in different areas of the Gulf of Finland (K. Döös, Meteorological Institute, University of Stockholm, unpublished calculations) suggest that pollution released into this gulf has a high chance to hit the Estonian coast (see the figure below).

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[17] Elken J., Raudsepp U., Lips U., 2003, *On the estuarine transport reversal in deep layers of the Gulf of Finland*, J. Sea Res., 49, 267–274.

Elken J., Mälkki P., Alenius P., Stipa T., 2006, *Large halocline variations in the Northern Baltic Proper and associated meso-and basin-scale processe*s, Oceanologia, 48(S), 91–117.

[18] Andrejev, O., Myrberg, K., Lundberg, P. 2004. Age and renewal time of water masses in a semi-enclosed basin---Application to the Gulf of Finland. *Tellus* 56A(5), 548--558

[19] Soomere, T., Quak, E. 2007. On the potential of reducing coastal pollution by a proper choice of the fairway, *Journal of Coastal Research*, Special Issue 50, 678–682.

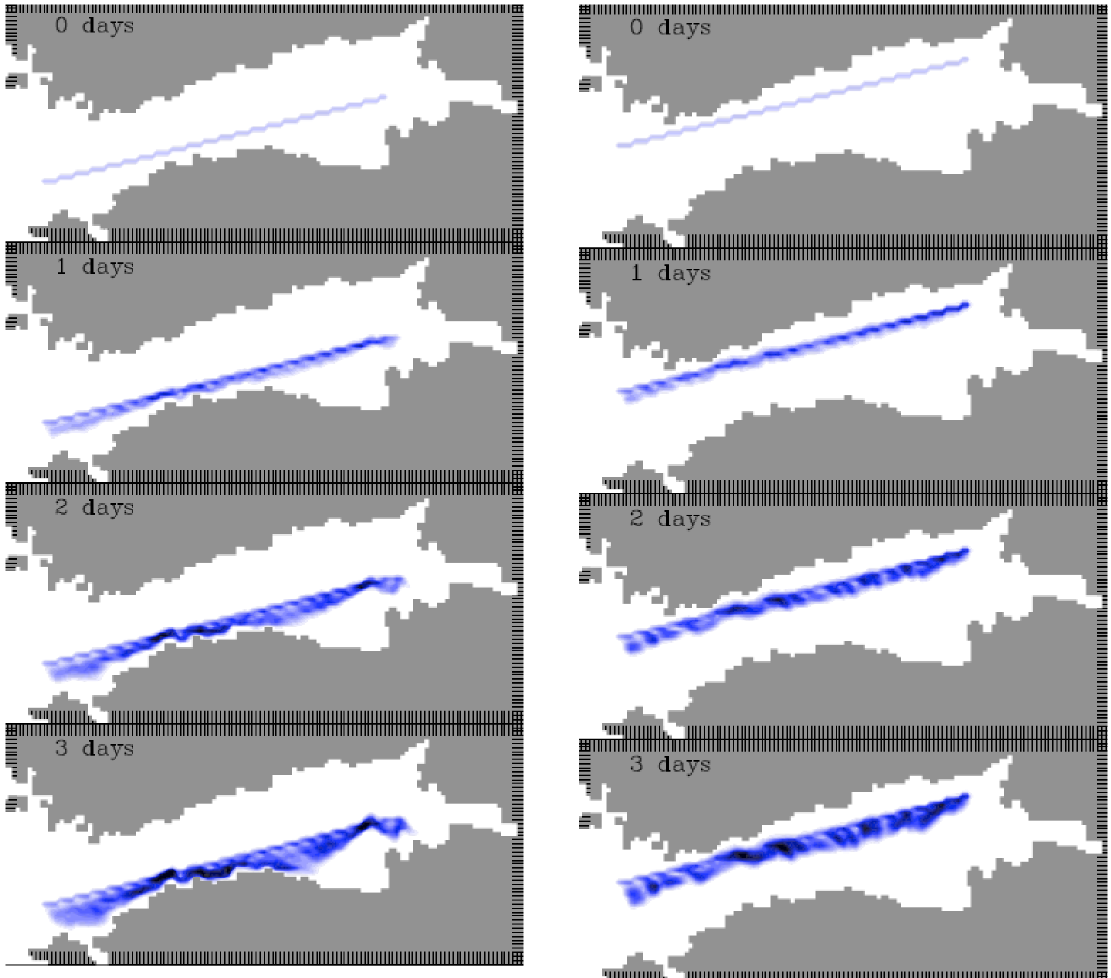

Figure 1. Transport of tracer released along the usual ship lane (left panel) and in the vicinity of the northern coast of the Gulf of Finland in SW wind conditions of 28 September 1994. Simulations by K. Döös.

This feature is of large concern for Estonia, because its presence may substantially increase the probability that pollution, toxic materials, chemical waste, etc., that will be resuspended during the construction works will be transported close to the southern coast of the Gulf of Finland and may heavily hit the protected and Natura 2000 areas located in the vicinity of Estonian coasts. Moreover, the described specific feature of transport patterns drastically increases the probability of the Estonian coast being hit by water masses with high concentrations of rinsing chemicals – that will be released into the territorial waters of Russia according to the actual work plan as made public in an expert meeting in May 2008 in Moscow. These aspects are completely overlooked in the documentation presented by the developer. For these reasons, the evaluation of the accompanying transboundary impact to Estonia is missing, and any assumptions made on “minor impact” are inadequate.

4.2.2. Geology, tectonics and seismicity

Statement on the quality of the report

The compilers of the report have failed to communicate how the key questions related to geological structure, tectonics, fault systems and related aspects of seismicity, subsea land slides relate to the risks in construction of the subsea installations. The information on bedrock geology does not meet the standards of current knowledge and has missed the extensive geological and geophysical research on submarine geology since 1980s to the present days. Information on seismicity is missing in the Espoo EIA. Danish and Swedish EIAs provide data on old earthquakes in Scandinavia from a textbook published in 1994, referring to an assumption that the probability of an earthquake of magnitude 5 is once in 500 years. However, after the Osmussaar earthquake in 1976 (magnitude 4.7) and the Kaliningrad earthquake in 2004 (magnitude over 5) recorded among the most significant earthquakes in 2004–2006 in the Council of Europe's major hazards network, the earthquake risks have been re-evaluated as significantly higher by the scientific and engineering communities. Also, the potential diversity in earthquake mechanism, hypocenter depth, and relation to the tectonic structure of Fennoscandian Shield have not been taken into consideration. The fact that the earthquake destruction ability does not depend only on magnitude but is a function of magnitude, the hypocenter depth, and the properties of soil is omitted.

In Fennoscandian Shield the seismic events are mainly of tectonic origin and therefore with relatively high destruction ability in respect to the magnitude. The extensive instrumental seismic monitoring data collected within last 50 years in Sweden, Finland and Estonia has determined the relatively higher seismic activity zone at the junction of Gulf of Finland and Baltic Sea, in the vicinity of steeply sloping areas of the seabed. This fact is completely ignored in the presented documentation. It is also obvious that only the instrumental datasets collected within last 50 years are authentic for precise seismic hazard estimations not the macro seismic data on historical events.

Inadequate information on any aspect of the risks used as input for risk analysis would lead to the failure of the overall risk analysis. Unfortunately, a great deal of the inadequate information in the EIA report stems from the poor presentation of geology and tectonics of the Baltic Sea area.

4.2.3. Gaps in evaluating secondary impacts

Statement on the quality of the report

The report has not recognised the impacts of the remobilisation of dioxins and other organic and inorganic substances, their transport with underwater currents, accumulation in the food web and toxic effects to piscivorous birds, marine mammals and human health. Also, the extensive remobilisation of nutrients and its influence to the Baltic Sea ecosystem has not been discussed.

4.2.4. Gaps in cumulative impact assessments.

The developer has identified the gaps of "the cumulative impacts of the pipelines with developments such as wind farms, new cables for telecommunications and the extraction of minerals in the Baltic Sea." However the cumulative impact of the potential highest risk – the potential crossing of the Nord Stream with the Balticconnector gas pipe in the Gulf of Finland that is evident from the introductory chapters, has not been emphasized. The Balticconnector gas pipe between Paldiski, Estonia and Inkoo, Finland, is promoted by the companies sharing the shareholders with Nord Stream: Finnish Gasum OY (Gazprom 25%, E.ON 20%) and Latvijas Gaze (E.ON 47.15%, Gazprom 25%). Consequently, Gazprom and E.ON are involved in planning two gas pipelines in the Gulf of Finland that will cross each other. Nevertheless, this key issue has been left out of the focus of attention and the cumulative risks of two crossing gas pipelines have not been evaluated.

4.3. Environmental monitoring

Statement on the quality of the report

The Espoo EIA Report does not contain a detailed environmental monitoring program which could be evaluated whether it is acceptable or not. Instead an outline of the program and the principles how the program will be finalized is presented. The procedures of program development and implementation are in accordance with the well known and accepted principles. The main concerns regarding the environmental monitoring program are the following:

First, in the present form the outline of the program excludes any monitoring activities regarding larger-scale impacts of the pipelines presence during the operational phase. The monitoring of impacts on water column is restricted to an objective "to establish accuracy of impact assessment regarding temperature changes induced by the pipelines and to provide context for the interpretation of benthic ecology" (page 1653). Marine benthos will be monitored according to the above outline only "immediately around the pipelines and on the slope of the trenched sections". At the same time, the Baltic Sea is defined as a particularly sensitive sea area. Although the experts involved in the EIA process have identified most of the receptors in the report as non-sensitive, we can not agree that the monitoring of impacts of the presence of pipelines to the deep water circulation and consequently to the ecosystem of the deeper areas of the Baltic Sea are totally excluded from the monitoring program.

During the construction phase suspended solids, sediment spill rate, extent and duration of the sediment plume will be monitored according to the monitoring program outline. It is not clear on the basis of what criteria this element of environmental monitoring would cease. Are these criteria region-specific (shallow areas vs deeper areas, Gulf of Finland vs open Baltic etc), weather-specific (calm weather vs moderate winds etc) and/or action-specific (munitions' clearance, rock dumping etc)? It can't be tolerated that such direct impacts will be not monitored in any circumstances. Furthermore this element of environmental monitoring has to answer also questions about the extent of direct transboundary impacts of sediment intervention works in the Finnish waters to the ecosystem in the Estonian EEZ since the pipeline route is in some places closer than 200 metres to this zone. Thus in the monitoring program a special objective and methods of assessment of this impacts based on direct measurements have to be elaborated.

4.4 Natura 2000

Statement on the quality of the report

Current assessment of impact of the project on Natura 2000 sites is based on the distance from the pipeline route. Based on distance criteria two existing Natura 2000 areas will be located to reach the „impact corridor" what was calculated based on expected immediate impact of underwater explosions on marine mammals during the munition clearance. The conclusion on the minor level of impact was mainly based on the fact that these Natura 2000 areas are designed to protect mostly terrestrial habitats and species. Here are several important aspects that have to be considered in Natura 2000 evaluation:

- Mentioned Natura areas have also listed marine habitats to protect.
- Mobility of marine mammals and cumulative effects of nutrient and toxic matter release from the sediments is not analysed in this aspect.
- Number of potential future Natura 2000 areas are located in the 20 km impact corridor. Information on those was made available for the EIA consultant but is not used in current EIA report.

CONCLUDING REMARKS

The experts contributing to this report share the opinion that the gaps in the presented final version of the Espoo EIA, where information on the large areas is missing and major risks are not treated with sufficient care require rejecting the report. The Espoo EIA report of the Nord Stream project and its public hearings have failed to meet the criteria of EU EIA directive and other relevant legislature. However, the lessons learned and the feedback from this project can be useful for the Developer for gaining knowledge and any future development projects.