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North European Gas Pipeline

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List of acronyms

BSH	Federal Maritime and Hydrographic Agency
CBSS	Council of the Baltic Sea States
CIP	Critical Infrastructure Protection
EEZ	Exclusive Economic Zone
EIA	Environmental Impact Assessment
HELCOM	Baltic Marine Environment Protection Commission
HELCOM CHEMU	The Ad Hoc Working Group on Dumped Chemical Munition
MBES	Multi-Beam Echo Sounders
MERCW	Modelling Ecological Risks related to Sea-dumped Chemical Weapons
NEGP	North European Gas Pipeline
NG1	Natural Gas 1
ROV	Remotely-Operated Vehicle
SSS	Side-Scan Sonar
TW	Territorial Waters
UNCLOS	United Nations Convention on the Law of the Sea

Abstract

The North European Gas Pipeline (NEGP) is one of the largest subsea gas pipeline projects in the world and is designed to provide EU member states with 55 bcm natural gas from Russia annually, which will be about 8% of the predicted total gas consumption in the EU in 2015.

The NEGP is by definition a critical infrastructure.

The probability of terrorist attacks or natural hazards that could damage or even disrupt the pipeline is rather low. Trawling and vessels anchoring near the pipeline strings pose more of a danger.

The effects of a disruption are local and global. Local effects are gas leakages and a possible gas explosion at sea level. The global effects are possible turbulences in the gas supply and natural gas market, which could burden consumers to a certain extent.

A special issue is the chemical and conventional munitions dumped in the Baltic Sea. Experts suggest that building and operating the NEGP will not cause major risks of releasing chemical warfare agents or explosion of conventional munitions. Nevertheless, this cannot fully be excluded, even if extensive investigations are carried out prior to the laying and operation of the pipeline. These investigations could provide valuable information about the existing risk that should be used in the respective international institutions (e.g. HELCOM) to re-evaluate the risk assessment made 15 years ago.

The Critical Infrastructure Protection strategy should focus on concepts how

- to secure and to safeguard the pipeline mainly against technological hazards as trawling or anchoring ships and
- to have well coordinated and effective emergency response, including the fast detection and repair of damaged parts of the pipeline.

Therefore agreements between the operator Nord Stream and the affected Baltic Sea states have to be made. Since the safeguarding work and emergency response touches on the security interests of the states involved, there seems to be a need to develop institutional solutions at political level.

1 The North European Gas Pipeline

1.1 Background

The North European Gas Pipeline (NEGP) is an offshore pipeline under construction from 2005 and 2010 (first line) / 2012 (second line) and operated by Nord Stream AG.



Figure 1 TEN-E priority axes. Source: EC, DG Energy and Transport 2005

The NEGP is planned along one of the priority axes of the Trans-European Gas Networks, the axis “Natural Gas 1” (NG1). This axis leads to the United Kingdom via Northern Continental Europe with connections to Baltic Sea states and to Russia (see Figure 1). Thus, the NEGP constitutes the Baltic offshore part of the NG1-priority axis¹.

It is designed to supply western European countries such as Germany, the Netherlands and the United Kingdom with 55 billion cubic meters of natural gas annually, mainly obtained from the Shtokman gas field in the Barents Sea (overall reserves have been estimated for 3.7 trillion tons).

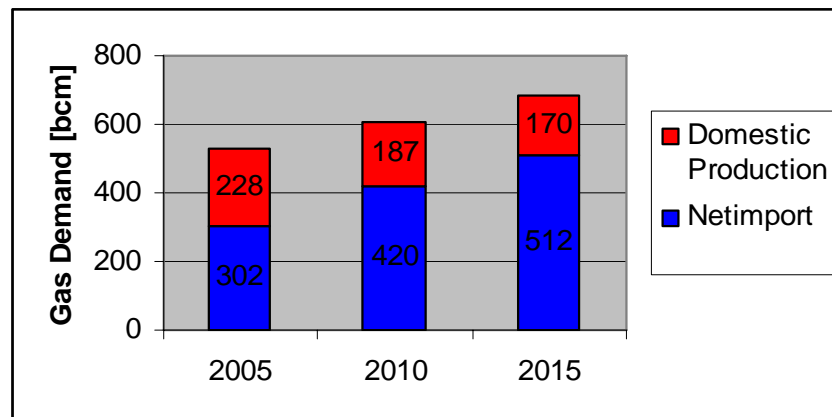


Figure 2 Projection of Gas demand in the European Union

According to a baseline scenario, the demand for natural gas is expected to increase between 2005 and 2015 from 530 to 682 billion cubic meters, whereas the domestic production will decrease from 228 billion cubic meters in 2005 to 170 billion cubic meters in 2015, creating an additional need to import 210 billion cubic meters natural gas in 2015. Nord Stream could provide about 25% of the natural gas needed (Nord Stream 2006a).

1.2 Technical design

The NEGP will have a total length of about 1,200 km, making it one of the longest offshore pipelines in the world. It will start from Portovaya Bay near Vyborg, Russia, and then run along of the Baltic seabed until it reaches its landfall in

¹ Although NEGP adheres the EU strategy, there are other possible route options for Trans-European Gas Network axis NG 1. Some states, such as Poland and Lithuania, regard an on-shore pipeline as the ecologically and economically soundest solution. However, Nord Stream fosters the implementation of an offshore pipeline that directly connects Russia to Western Europe for economic and security reasons.

Lubmin, near Greifswald, Germany. It will cross the Exclusive Economic Zones (EEZ) of five countries: Russia, Finland, Sweden, Denmark and Germany (Nord Stream 2006a and 2007a). The NEGP will be laid in depths ranging mostly from 20 m to 100 m, being at deepest in 210 m.

According to plans, there will be a service platform located in the Swedish EEZ, about 48 km east of the small island of Gotska Sandön, and 68 km northeast of the main island of Gotland. Service platform's main functions are told to be commissioning support, operational support/maintenance of the pipelines, providing flexibility in case of an operational problem and isolation in case any of the pipelines are damaged. The platform will be unmanned, with the exception of temporary maintenance workers. The service platform will be about 40 m long by about 30 m wide, with the height of the main structure above the surface of the sea about 40 m. It will not be visible from any point on land. (Nord Stream 2007b)

Table 1 Intersections of Nord Stream with Exclusive Economic Zones (EEZ) and Territorial Waters (TW) in the Baltic Sea. (Source: Nord Stream 2006a)

Country	EEZ (km)	TW (km)	Total (km)
Russia	96	22	118
Finland	369	0	369
Sweden	482	0	482
Denmark	149	0	149
Germany	33	45	78



Figure 3 Milestones for the NEGP-project. © 2007 Nord Stream

According to latest information from Nord Stream (2007a), the project preparation phase entered into a detailed planning phase on 1 January 2007. The start of the main construction is scheduled for the third quarter of 2008 and will be finalised in 2010. The second line is expected to operate in 2012.

Fact Box 1 Basic and technical facts of the North European Gas Pipeline

Route	Subsea pipeline from Portovaya Bay near Vyborg, Russia to the coast of Germany to Lubmin near Greifswald, Mecklenburg-Western Pomerania.
Service platform	In the Swedish EEZ, about 48 km east of the small island of Gotska Sandön, and 68 km northeast of the main island of Gotland. The size of the service platform will be about 40 m x 30. The height of the main structure above the surface of the sea will be about 40 m.
Constructor	Nord Stream AG http://www.nord-stream.com
Shareholders	OAQ Gazprom (51%), Wintershall AG (24.5%), E.ON Ruhrgas AG (24.5%)
Estimated investment	min €5 billion
Gas capacities	55 bcm per annum (2 pipelines with 27.5 bcm capacity each)
Pipeline length	1198 km
Max. water depth	210 m
Project start	2005
Completion of the first line	According to plan – in 2010
Completion of the second line	According to plan – in 2012
Pipeline diameter	1,220 millimetres / 48 inches
Design pressure	220 bar
Pipe steel standard	DNV Offshore Standard OS-F101; Steel grade: X-70
Wall thickness	27-41 mm.
Coating	Interior antifriction coating of 0.06 mm epoxy layer; Exterior anticorrosive PE or PUR coating; Passive anticorrosive protection is ensured by aluminium sacrifice bracelet anodes
Gas supply resources	Yuzhno-Russkoye oil and gas reserve, Yamal Peninsula, Ob-Taz bay and Shtokmanovskoye fields

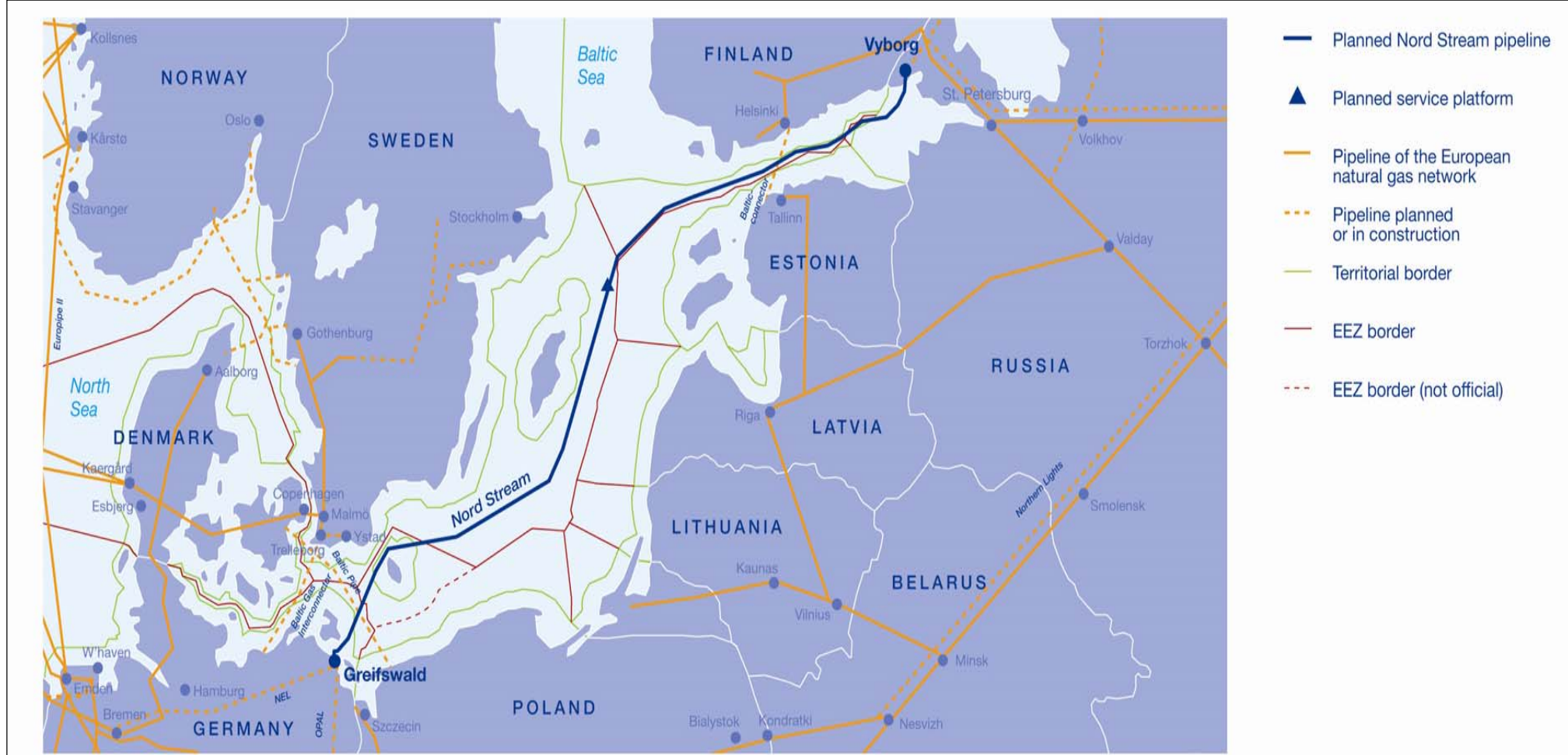


Figure 4 Route of the pipeline proposed by Nord Stream. © 2007 Nord Stream

1.3 State of permission procedure

According to the 1982 United Nations Convention on the Law of the Sea (UNCLOS), the Exclusive Economic Zone (EEZ) falls under national jurisdiction. This covers the construction and operation of pipelines (UNCLOS 1982). The consortium Nord Stream is therefore obliged to obtain all necessary permits according to the national law that applies in the EEZ crossed by the NEGP.

The necessary permits demand an Environmental Impact Assessment (EIA) for each of the EEZ as well as for Territorial Waters (TW) crossed by the NEGP. In addition, the construction and operation of the NEGP is subject to the “Convention on environmental impact assessment in transnational context” agreed at Espoo, Finland, on 25 February 1991, since the construction of “large-diameter oil- and gas pipelines” is regarded to “cause a significant adverse transboundary effect” (Espoo-Convention, Annex I, no. 8). This means that all parties of the convention have to be notified about the EIA procedure to be given the opportunity to participate in the respective EIA procedures.

In case of the NEGP, the parties of origin (meaning those states whose EEZ or TW are crossed by the planned pipeline and who are responsible for EIA-procedures) are Russia, Finland, Sweden, Denmark and Germany. They notified the affected parties, which are all the states of the Baltic Sea Region, about the nature of the planned measure. The affected parties indicated their desire to participate in the relevant EIA-processes.

The EIA has to be elaborated by Nord Stream before decisions are made, and it includes public consultation where affected parties may participate. The procedures as well as the content of EIA differ between the parties of origin.

Taking the German EIA procedure, it is expected that the results of all EIAs will provide essential information on risks connected with construction and operation of the NEGP. However, they might not cover all information relevant for Critical Infrastructure Protection (CIP) issues as following chapters will show.

Fact Box 2 Permission procedure for NEGP in German EEZ and TW

On 11 November 2006 Nord Stream applied for permission of construction and operation of the pipeline in German EEZ and TW at the Bergamt Stralsund (Federal Mining Agency Stralsund, subordinated to the Mecklenburg-Vorpommern Ministry for Economic Affairs, Labour and Tourism) as well as at the Bundesamt für Seeschifffahrt und Hydrographie (Federal Maritime and Hydrographic Agency, BSH).

The BSH states in its notification in accordance with Article 3 of the Espoo-Convention, that three different permits are required for the construction of the pipeline (BSH 2006):

- “1. According to § 43 Energy Trade Law, a planning approval by the Federal Mining Agency Stralsund is needed for the section of the pipeline in German Territorial Waters.
2. According to § 133 fig. 1 Federal Mining Law, an approval with regard to technical and safety aspects by the Federal Mining Agency Stralsund is required.
3. According to § 133 fig. 2 Federal Mining Law, an approval with regard to the use of the waters and environmental aspects by the BSH is required.

An EIA is obligatory for decisions fig. 1) and 3).”

The application of Nord Stream included a scoping document, where the potential environmental impacts of the measure as well as the proposed assessment of the environmental impacts are described (Nord Stream 2006b).

The responsible authorities, the BSH and the Bergamt Stralsund jointly decided upon the methodological framework for the EIA.

According to this decision the EIA will touch concerns of CIP in some points, e.g. (BA Stralsund / BSH 2007):

- a description of effects of damages to the pipeline by external impact which could be terrorist attacks or natural disasters,
- a small-scale investigation (side scan sonar) and a large-scale investigation (magnetometer) of dumped munitions for the entire track; both approaches should cover at least 15 meters width,
- an assessment of the effects of possible clean-up of munitions,
- an assessment of the effects of a sudden gas leakage to the coastal population.

2 Threat scenarios

Both the “Proposal for a directive of the council on the identification and designation of European Critical Infrastructure and the assessment of the need to improve their protection” and the “Communication from the Commission to the council and the European Parliament - Critical Infrastructure Protection in the fight against terrorism” classify “energy installations and networks (e.g. electrical power, oil and gas production, storage facilities and refineries, transmission and distribution system)” as critical infrastructure (European Commission, 2004 and 2006).

The following threats are examined here:

- Terrorism-related hazards,
- Natural disasters,
- Hazard from dumped munitions,
- Other hazards.

2.1 Terrorism-related hazards

Pipelines have been targeted for terrorist attack, although there are no known successful attacks on underwater pipelines (Australian Office of Transport and Security 2004).

Nevertheless, terrorist attacks on offshore oil and gas facilities have taken place, such as the repeated attacks on Nigerian offshore oil-platforms (FOI 2007).

Attacks on or accidents at on-shore pipelines are frequent, mainly in critical hot-spots. Pipeline systems are strategic goals of terrorists and rebels, such as in Iraq, Pakistan, Nigeria, Assam, Chechnya and Kurdistane (IAGS 2005).

Attacks and accidents can disrupt oil or gas transmission. The media and energy market is sensitive to bad news, as has been demonstrated recently with the explosion that damaged a Ukrainian pipeline (Der Tagesspiegel, 7 May 2007). Experts talk of “fear premium” that is added to gas and oil prices. According to the Institute for the Analysis of Global Security this “fear premium” makes up about 10 US\$/barrel oil (IAGS 2005).

National bodies responsible for security issues and security experts see a general possibility for terrorist attacks against offshore gas infrastructure. Each method of attack used in the following scenarios involves a high degree of difficulty given the location, size and complexity of the infrastructure (Australian Office of Transport and Security 2004):

- Direct attack,
- Armed intrusion,
- Hijacked vessel/aircraft,

- Sabotage
- Underwater attack.

The extended and isolated nature of the pipelines from offshore facilities, make it practically impossible to guard them. However, the threat to offshore pipelines is reduced by the depth at which they traverse the seabed, thereby presenting a significant difficulty for would-be attackers (Australian Office of Transport and Security 2004).

However, security experts regard a pipeline as a fairly vulnerable object, where one diver would be enough to set an explosive device (FOI 2007).

Generally, the likelihood of a terrorist attack is regarded as rather low, since the political situation in the Baltic Sea Region is stable. Nevertheless, experts reckon that there are threats to Russian interests and citizens. If the current trend continues, the situation will worsen and, because the pipeline is meant to be in operation for five decades, a high level of uncertainty must be reckoned with (FOI 2007).

2.2 Natural disasters

Generally, seismic events, tsunamis, rough sea with strong swells, onshore winds, and storms could affect a subsea pipeline. Problems are also created by buried subsea pipelines becoming exposed, particularly after violent wave action associated with storms. This may cause stability problems or free spanning, which are both potential hazards for the pipeline (Pipeline and gas journal 2000). The landfall pipelines are exposed to the risk of rockfall impacts and the ice cover of coastal area (Nord Stream 2006a).

Experience from the Gulf of Mexico shows that pipelines on the seabed suffered only minor damage after major hurricanes; most damage affected platforms and risers leading from bottom pipelines to the surface and for pipelines up to a depth of 60 meters (DNV 2006).

In North Sea, sea storms have been known to expose pipeline trunks, which leads eventually to larger free spans and thus more stress on the pipelines (Bijker 2000).

For NEGP, sea storms, rockfall and ice cover come into question, since seismic events or tsunamis are unlikely in the Baltic Sea Region.

2.3 Dumped munitions

A special point in discussion is the history of the Baltic Sea as a dumping ground for chemical and conventional munitions. The interaction between Nord Stream and the dumped munitions seems to constitute a specific threat scenario.

After the first and second world wars tens of thousands of tons of conventional and chemical munitions were dumped at different places in the Baltic Sea.

Dumped chemical munitions in particular were subject to investigations by the Baltic Marine Environment Protection Commission (HELCOM). The Ad Hoc Working Group on Dumped Chemical Munition (HELCOM CHEMU) states in its "Report on Chemical Munitions dumped in the Baltic Sea" of January 1994, that "about 40,000 tons of chemical munitions including 13,000 tons of warfare agents

have been dumped” in the Baltic Sea (HELCOM CHEMU 1994). But according to figures provided by the German BSH, 58,300 tons of chemical munitions were dumped east of Bornholm alone (Nehring/Ilschner 2005). Other sources also assume that the amount of chemical munitions dumped in the Baltic Sea is higher than stated in the before mentioned report of the HELCOM CHEMU working group (MoND 1999). Investigations by a Russian specialist team revealed that corrosion of dumped chemical munitions trunks has advanced dramatically and that the Baltic seabed contains 3 grams / kilogram of arsenic (Berliner Salon e.V. 2007, Paka 2007).

Closely related to the dumping of chemical munitions is the dumping of conventional munitions (which took sometimes place simultaneously) and the appearance of mine belts in Baltic Sea coastal waters.

Dumped conventional munitions have not been investigated so far. There are only uncertain figures in the scientific literature. It is estimated that from Schleswig-Holstein’s harbours alone 100,000 tons of conventional munitions were dumped in the Baltic Sea (Nehring/Ilschner 2005).

There was extensive mining of the Baltic Sea area during World War II. Apart from German, Russian and Finnish minefields, there were also Swedish and British minefields. According to the literature, about 120,000 sea mines were laid between 1914 and 1945. Although some have been cleared, others are still active, especially along the southern Baltic coast and in the Gulf of Finland (Nehring 2006).

Nord Stream’s strategy is to investigate the line corridor for dumped munitions, to avoid dumping sites by alternative route design and to clean-up dumped munitions where necessary and possible.

In 2005, 2006 and 2007 Nord Stream carried out investigations of the seabed.

The first detailed screening of Nord Stream’s provisional route was carried out by PeterGaz in 2005. This was principally a geophysical survey to check the condition of the seabed across a 2 km corridor and to look for obstacles such as wrecks, large boulders and trenches.

On the basis of the 2005 survey data, two potential pipeline routes were selected. These were investigated in 2006 during a second seabed survey, which covered a 180 metre-wide corridor along the entire length of the proposed pipeline. Nord Stream then deployed a remotely-operated vehicle (ROV) to inspect each target in detail within 20 metres of the route.

As a result of the 2005 and 2006 surveys, only two targets were clearly identified as mines and only one is thought to be intact.

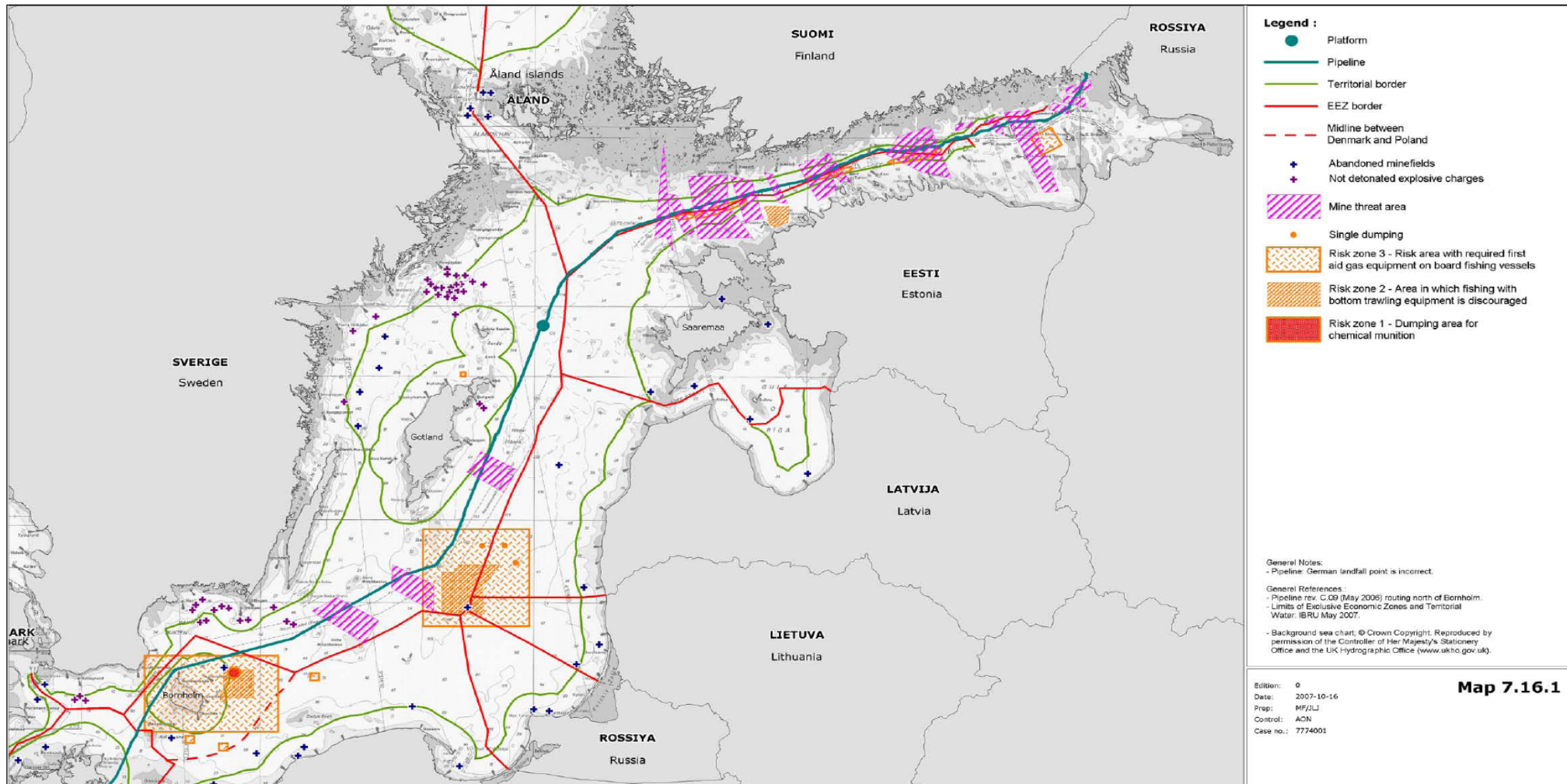


Figure 5 Dumped munitions in the Baltic Sea. © 2007 Nord Stream

Since July 2007 a three-step approach is being applied. In the first stage the installation corridor (15 metres) is surveyed with multi-beam echo sounders (MBES), high-resolution side-scan sonar's (SSS), sub-bottom profilers and magnetometer. In the second stage a 6.7 metre-wide 12 sensor gradiometer array mounted on a ROV is used to detect any ferrous (iron-based) metals on the seabed and in the third stage, objects detected in the previous stages will be visually inspected.

2.4 Other Hazards

Additional threats to sub sea pipelines are mentioned in the literature as being anchoring, trawling and fishing.

Trawling or the anchors of drifting ships may cause damage, e.g. moving the pipelines or disrupting them. For this reason, some countries like Australia or New Zealand even prohibit anchoring and fishing in designated pipeline corridors (Burnett, 2006).

The probability of such incidents to subsea pipelines is regarded much higher than the probability of terrorist attacks or natural hazards. Damage to pipelines caused by vessels (anchoring, running to the bottom) has been estimated to be once per 237 years (Mazurkiewicz 2007).

3 Impacts caused by terrorism-related occurrences, natural disasters and dumped munitions

The following chapter describes the impacts resulting from direct pipeline damages as well as impacts caused by the construction and operation of the pipeline.

Natural disasters and terrorist attacks may cause direct damage to subsea pipelines by moving them out of position, interrupting or damaging them in a way to cause a gas leak. The worst case of a direct impact is certainly the total disruption of the pipeline. Other direct damage could be the damaging of landfalls and pressure stations.

Due to the situation in the Baltic Sea with regard to dumped munitions, further indirect effects of the construction of the pipeline are imaginable: dumped munitions could explode during construction or warfare agents could be released due to construction work (damage to munition trunks) or increased corrosion caused by the removal of sediment and exposure of metal trunks to salt water.

3.1 People at risk

Direct damage to the NEGP will most probably result in impacts that are locally limited and affect single groups of persons rather than have a greater impact on people. However, it seems it cannot be excluded that leaking gas could cause vessels to sink, maybe even tankers with hazardous load, either by an explosion or due to a large gas bubble, such as described by Hupka (2007).

Unexploded ordnance, such as bombs, grenades or sea mines, could harm the crew of a ship near the explosion. In 2005, three Dutch skippers were killed by a mine explosion. From the available literature it seems that there is not enough knowledge about the behaviour of dumped conventional munitions over time. For example it is point of contention whether munitions deactivate due to corrosion or if self-ignition is likely. There may be a severe risk to pipeline workers, since digging and dredging could cause an explosion near to a pipeline construction vessel.

Up to now, the warfare agents released from chemical munitions dumped in the Baltic Sea have not cause fatal casualties. Nevertheless a number of fishermen have been injured, mainly by mustard gas munitions caught in their fishing nets. Danish records show 342 chemical munition incidents between 1985 and 1992 east of Bornholm (HELCOM 1994) and around 100 incidents between 1995 and 2005. There was a tragic accident in 1955 in Poland when 102 children were injured when they played with a mustard gas munition washed up on a beach near Darlowek. The impact of mustard gas is severe and takes a long time to recover from exposure to it (MoND 1999). Statistics from Denmark indicate a certain

decrease in munitions incidents during the last two decades, but those statistics do only represent a part of the munition incidents, since foreign fishermen are not obliged to report to Danish authorities.

Fact Box 3 Effects of a gas leak on the NEGP (Nord Stream 2006a)

“If the pipeline is punctured or torn apart, it will take some time before the pressure fall is registered at the landfalls at compressors and at the service platform and the security system automatically closes the valves of the pipeline. The gas will bubble into the water and reach the sea level. From there the gas will spread in the atmosphere depending on the meteorological conditions and the weight of the gas in relation to the surrounding air, etc. In connection with the release of gas, the gas will cool down, and may become heavier than the surrounding air. However, in connection with the rise of the gas plume in the water the gas will be heated up and it is expected that the gas when reaching the sea level will be lighter than the surrounding air. Thus, no heavy gas cloud will be formed at sea level. The gas will most probably disperse into the atmosphere. If the ignition source is onboard a passing ship, or on board the ship that has caused the rupture/leakage (anchor damage), there will be a risk to the personnel onboard the ship. This risk will be further evaluated at a later stage of the project. It should be mentioned that an accident with outlet of gas will be very rare with a frequency, calculated for the planned Baltic pipeline, which corresponds to an accident once in about 1,000 – 10,000 years”.

For other warfare agents, such as Clark I, Clark II, adamsite, lewisite and winter sulphuric yperite accumulation of arsenic in biosphere cannot be excluded. Whether the decomposition will create non-toxic substances is not fully understood (MoND 1999, Kasperek 2007).

The risk to people, either from direct damage to the pipeline or by indirect impacts during the construction and operation of the pipeline seems highest for specific groups, e.g. fishermen, ship crews and pipeline workers.

A general impact on a greater number of people seems rather improbable. But it could happen that a gas leakage could cause major accidents involving tankers or ships with hazardous loads.

There seems to be rather low evidence for the assumption that the construction and the operation of the NEGP could significantly worsen the current situation concerning dumped chemical munitions since the NEGP is limited to a narrow corridor and extensive investigations are carried out prior to construction.

*Table 2 Pull-outs of chemical munitions east of Bornholm registered by Denmark.
(Sources: *: HELCOM 1994, **www.helcom.fi (16.10.2007))*

Year	Number of catches	Weight of chemical munitions in kg	Weight of active gas in kg
1985*	46	2695	
1986*	41	1830	
1987*	14	582	
1988*	19	1044	
1989*	42	1966	
1990*	19	979	
1991*	103	5378	
1992*	58	2597	
1993			
1994			
1995**	6		40
1996**	10		210
1997**	9		184
1998**	5		290
1999**	3		185
2000**	11		512
2001**	11		514
2002**	10		345
2003**	25		1110
2004**	4		160
2005**	4		105

3.2 Economic consequences

Gas leakage and the resulting reduction of gas delivery will first of all result in lower revenues. The direct economic damage from a gas leakage of one of the pipelines depends on the severity of the damage and the time it takes to detect and repair the leak. Given a complete interruption, an annual discharge of 27,5 Bcm (daily discharge at 75,000 Tcm) for one string and an average price level it would create revenue losses of about 10 to 20 million EUR/day, which is substantial.

The Australian Office of Transport and Security states that a terrorist attack could weaken international confidence and damage future foreign investment in Australia's energy industries. Indirect effects could include short-term oil price instability; pressure on joint offshore development and security arrangements between Timor-Leste and Australia; potential reluctance to work on offshore facilities; attendant bad publicity; and the imposition of additional security and

hiring costs to operators of offshore-related or maritime-related enterprises (Office of Transport and Security, Australia 2004: 12-13).

When considering indirect economic damage, one has to bear in mind that only the transfer of gas would be affected, not its production. The impact of the gas cut in January 2007, when Russia stopped its delivery to Ukraine, did not greatly affect the European economy. This was mainly due to the combination of availability of storage capacities, the activation of other supply chains and the warm winter. The consequences of a shut-down of the NEGP should be regarded in light of its contribution to gas supply. The gas supply via the NEGP will account for about 11% of total imports from Russia to the European Union, whereas imports via Ukraine make up two thirds of European gas import from Russia. So called “fear premiums” could hit mainly the consumers in Western Europe by temporarily rising gas prices.

The direct economic damage resulting from contamination by toxic warfare agents should be rather moderate since it has mainly local effects. Indirect economic impacts connected to a worsened public image of coastal Baltic Sea regions if accidents with dumped munitions are reported more frequently are unlikely. It has not yet been investigated whether the decomposition of dumped munitions due too corrosion could lead to accidents in coastal areas where especially the tourism and fisheries sectors could suffer losses. Nevertheless there have been accidents reported previously in that media (e.g. ZDF 2005) and it was stated that white phosphorus has been released due to a geological survey in the coastal waters near Usedom (AET 2007). It is however rather questionable whether the NEGP will cause such effects since extensive surveys are carried out prior to laying the pipeline. Paka (2007), states that other hydrotechnological investments (e.g. subsea cable) did not worsen the situation of released warfare agents.

3.3 Environmental damage

Responses to the proposal of Nord Stream regarding the Environmental Assessment for Finnish / German EEZ revealed major concerns that are related to the construction of the pipeline (BA Stralsund / BSH 2007, Finnish Ministry of the Environment 2007):

- Impact on the Natura 2000 network,
- Impact on fish stocks and bird life,
- Alteration of the seabed,
- Dumped munitions and ship wrecks.

These are mainly related to the construction phase of the pipeline, and in this case the impact is limited in time.

Concerning biota, the greatest concern is the impact on fish-stocks and on bird species due to disturbance during the construction of the pipeline.

The seabed could be negatively influenced by necessary construction works, dredging, filling and blasting. Sediments could be disturbed as well as local sea

currents. Fine sediments could be shifted abroad; harmful substances contained in the sediment could be released.

The comments (especially from Finnish authorities) to the proposed Environmental Assessment show clearly that there are substantial concerns. Finnish authorities therefore wish to model long-term risks mainly connected to sedimentation and the release of harmful substances to better evaluate associated risks.

Concerning chemical weapons, the project “Modelling Ecological Risks related to Sea-dumped Chemical Weapons” (MERCW) is being carried out within the 6th Framework Program by the Finnish Institute of Marine Research. No final results are yet available.

Another issue that up to now cannot be fully judged is the question of conventional munitions and release of harmful substances such as heavy metals from corroded bombs.

It seems that the possible environmental impacts have not yet been assessed sufficiently, and it may be assumed that the construction of the pipeline will alter environmental conditions. On the basis of available information it cannot be said whether the construction of the pipeline will have indirect effects, such as enhancing the corrosion of chemical and conventional munitions leading to a faster release of toxic or harmful substances. It is also unclear how the warfare agents will behave once set free in larger proportions.

4 Critical Infrastructure Protection Strategy

Although the probability of attacks and natural disasters that could harm the NEGP is rather low, the effect of this could be substantial taken the importance of the pipeline (the NEGP will provide 8% of the total European gas demand) and the side effects concerning dumped munitions.

Therefore, in a Critical Infrastructure Protection strategy (CIP strategy) hazard scenarios should be described and responsibilities for prevention and mitigation of the hazards should be defined.

In case of the NEGP the CIP Strategy should address following issues:

- Securing the NEGP against trawling and anchoring vessels,
- Safeguarding of the most vulnerable parts of the NEGP (landfalls in Vyborg and Lubmin as well as the service platform),
- Emergency response and repair of damage to the pipeline,
- Avoidance of side effects of building and running the NEGP related to dumped munitions.

4.1 Political dimension

Even if the NEGP is seen as a private sector activity, its strategic role in gas supply for the European gas market and the fact that it runs through the EEZ of five Baltic Sea states makes it a political issue.

The plan of Nord Stream to erect a service platform next to the Swedish island of Gotland followed an intensive public debate in Sweden. A major concern was possible intelligence collection by Russia. This debate was fed by a statement by Vladimir Putin who said in a TV interview that the Russian fleet's "role is to protect our economic interests in the Baltic Sea region [...] Protecting the Northern European Pipeline, which brings energy resources to our Western European customers, is one of our most important priorities" (quoted from Pursiainen 2007).

Later, Nord Stream has tried to build confidence especially as to the use and protection of the service platform by stating that "in case any surveillance is needed, it is the responsibility of no one else but the Swedish Coast Guard" (Nord Stream 2007b).

Major concerns about the NEGP have been expressed by Poland, whose Minister of Defence stated that "Poland has a particular sensitivity to corridors and deals above its head. That was the Locarno tradition and the Molotov-Ribbentrop tradition. That was the 20th century. We don't want any repetition of that" (quoted from Pursiainen 2007). The importance of the issue is shown by the fact that the Polish parliament (Sejm) organised an international conference in May 2007 to

discuss the issue with experts (International Conference on Environmental Threats to the Baltic Sea, Warsaw, 28 May 2007).

It is important that those states supporting NEGP – Russia, Germany, Denmark and Finland - and the states with concerns about it would find a common ground at the political level.

Even if the United Nations Convention on the Law of the Sea (UNCLOS)² clearly states that the pipeline operation should not be impeded, additional efforts about the relevant security issues are needed.

4.2 Institutional dimension

Nord Stream is responsible for operating the NEGP and principally Nord Stream should have highest interest in developing and implementing a CIP strategy for NEGP in order to avoid economic losses (see sections 3.2 and 4.3 above).

To avoid these losses, it has to be assumed that Nord Stream will take care of detecting pipeline damage continuously and the fast repair of damaged parts of the pipeline.

More complicated is the field of safeguarding and complex reactions in emergency responses that might be necessary in rare cases. Even if the risks mentioned above are low, the safeguarding of a pipeline that crosses the Baltic Sea at a length of 1,200 km is a multinational task. There must be a sound strategy developed together with experts from the affected states that concentrates on crucial points such as landfalls or pressure stations.

But first it has to be clarified who is responsible for safeguarding the pipeline (national coast guards, private security services, national intelligence agencies). Many mainly operational questions follow:

- By which means and what information will be gathered?
- How this information will be stored and analysed?
- Will it be partly shared between involved security operators (intelligence agencies)?

Secondly, it has to be clarified who is responsible for emergency responses (national coast guards, private services, Nord Stream), as well as who, and in what

²UNCLOS

Article 210: According to UNCLOS, pollution resulting from dumping shall be prevented by the responsible coastal state.

Article 79: According to UNCLOS, all states are entitled to lay pipelines on continental shelf, coastal states may not impede the laying or maintenance of such cables or pipelines

cases, will lead the emergency response action? Of course, reaction plans and trainings are essential.

In order to find the way forward, and keeping in mind that the CIP of the NEGP has a political dimension, it seems advisable that the CIP strategy be developed and implemented by a broader panel comprising security experts and political decision makers.

For this purpose existing bodies, such as the Council of the Baltic Sea States (CBSS), should be considered to see whether they could moderate the process. It would also be possible to establish a separate - intergovernmental / interadministrative - working structure.

Another special issue is the dumped munitions, which extend beyond the NEGP. Being part of the CIP strategy for the pipeline track it should be discussed comprehensively in a broader forum, already established in HELCOM. It is essential that all available information concerning the investigation of dumped munitions is made available to HELCOM and that, based on an actual evaluation of the potential risks, the need for further action is decided at a political level.

4.3 Economic dimension

Since the most significant effect of a pipeline disruption could be turbulences in gas markets, CIP has to find solutions for securing gas supply by either re-routing the supply via other pipelines or assuring enough storage volume to overcome a period lasting from several days to several weeks.

The costs for securing and repairing the NEGP are presumably small in comparison to the revenue loss, should the pipeline be disrupted. Therefore the protection of the NEGP should be a clear task and in the interest of Nord Stream and the consumers that benefit from it.

4.4 Social dimension

The CIP has to be directed mainly to those groups and people that would be most directly affected by accidents along the pipeline, such as fishermen, ships' crews as well as pipeline workers.

The NEGP could also support information campaigns to people living along the Baltic Sea coast about what to do in case of accidents involving dumped munitions.

4.5 Technological dimension

The CIP should take into account two aspects: the technological opportunities in safeguarding using new technologies (cameras, satellites, sonar) as well as the vulnerabilities of pipelines to attack, which is why the access by terrorist groups to technology have especially to be continuously monitored.

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