Orange

Book

One

Building a Macro-Regional Approach:
A Nuclear Safety Risk Scenario for the Baltic Sea Region

Editors’ Letter

This Notebook is one of nine in the Fourteen Point Three Notebooks collection brought together by the European Union Strategy for the Baltic Sea Region flagship project 14.3 (read: fourteen point three).

Eight Notebooks will present you with findings from our project’s four different working groups (named Task Groups C, D, E and F), and one Notebook will introduce a general overview of the whole project.

We hope that the collection as a whole will give you a sense of the unfolding diversity and complexity of the project, whilst retaining homogeneity as a single vision and ideal.

The singular Notebooks present concrete results (studies, workshop reports, developed methodologies and scenarios). The structure of the entire collection intends to act as a mirror for the project as a whole, and to reflect on the process as much as the output. Each of the books can be read singularly as a study presenting concrete findings from working groups, at the same time they can be read as a collection. Manifested together we view this as the symbolic added value brought to the macro-regional conversation by the project 14.3.

These values could be: the network, the will for cooperation in general terms, the challenges in finding a uniform language among different civil protection cultures and traditions, and the motivation to find commonality amongst the different departure points.

Orange Book One and Two bring you the outcomes of the Task F work. Task F, one of the three area specific tasks of the project 14.3, investigated current nuclear safety preparedness and risk with an aim to identify gaps in the Baltic Sea macro-regional context. It is our duty to acknowledge here that nuclear and radiation safety related cooperation has a long and vivid tradition in our region. The longest running pan-Baltic civil protection working body was established in 1992 by the Council of the Baltic Sea States – it is now known as the Expert Group on Nuclear and Radiation Safety (EGNRS). The main contribution of the 14.3 project and its Task F was, however, a first of its kind attempt to begin identifying risk and gaps in a truly macro-regional way, a process which can only be enabled by inquiry into an accident that is cross-border in its nature. For this reason, a scenario specifically tailored to the Baltic Sea macro-region was developed and assessed by Task F experts. The main condition for this scenario was that by definition, one country standing alone would not be able to cope with the consequences. Orange Book One brings to you this very first macro-regional nuclear accident scenario tailored for the Baltic Sea region.

It is our pleasure and honour to be sharing with you this vision of cooperation through our Orange Books in particular, and the Fourteen Point Three Notebooks in general.

Editors of Fourteen Point Three Notebooks
Egle Obcarskaite – Anthony Jay Olsson

Summary of the Project

14.3 was a project implemented under the EU Strategy for the Baltic Sea Region (EUSBSR), Priority Area Secure (Priority Area 14 in 2009 version of the EUSBSR Action Plan). The whole priority area calls for an insurance that contributions in the field of civil protection encompass the overall Strategy objectives (save the sea, connect the region, increase prosperity). The project 14.3 responds specifically to the objectives through addressing the necessities of bringing together and coordinating civil protection stakeholders and bolstering the capacity of individual countries, in order to ensure our region's uniform resilience to macro-regional risks.

14.3 was developed from a belief that considering the nature of the world that we live in today, only by ensuring a proper level of resilience on a macro-regional level can we ensure a higher level of resilience and preparedness on the national level as well.

Project 14.3 was a pioneering effort. →

Not only for addressing the topic of macro-regional risk in the Baltic Sea region (before this project there wasn't even a common concept discussed among the countries in the region), or for bringing up a complex all-hazards approach, but also for bringing together a partnership consisting of all countries in the region, to not only discuss and share but develop together a strategic approach to civil protection. As such, it thus constitutes a shift in the whole paradigm of the way civil protection may be conceived on a macro-regional level.

Why it is only now that 14.3 could have happened? →

Some say because there was previously never this level of openness in sharing information on civil protection tools and methods among different countries in the region; this could not have been imagined twenty or even five years ago. Others say it was because countries in our region finally openly recognized their individual vulnerability, as well as the fact that there may be situations to which even the most resourced country would face the need to ask for assistance from a neighbour. 14.3 partners came together admitting it straight: it is not enough to ask – you have to be ready to receive assistance.

Pioneering efforts also meant that 14.3 was a daring effort. →

This was especially visible in how the all-hazards approach had to be adopted for the project. All-hazards approach is a challenging claim even on national level, as it requires crossing administrative and institutional boundaries. Which is the best way to achieve this? The answer is yet to be formulated.

Project 14.3 proposed to take one step at a time and responded to the all-hazards challenge through structuring the project in four thematic tasks. There were three tasks dealing with the following hazards: floods, forest fire and nuclear accident. Whereas one task – Task C – engaged in an overall strategic discussion on how can risk be assessed and analysed on a macro-regional level, and how a common risk-discourse can decrease societal vulnerability of each singular country in the Baltic Sea region, as well as that of the macro-region as a whole.

Working Together on Macro-Regional Risk.

Project 14.3

Was the First Time that the Countries Around the Baltic Sea Worked Together on Macro-Regional Risk*

Why do we focus on MACRO-REGIONAL RISK?

Because risks - and their impact - do not pay attention to national borders

Develop scenarios – identify gaps

To Become a Platform for Further Deepening Our Experience & Sharing

Why do we take an ALL-HAZARDS APPROACH?

Because this is the only way to find out whether we are really prepared for emergencies that may occur in our countries, in our region

OUR ANSWER IS: a common method, common approach channeled through one network

What is the mission of a project like 14.3, – first of it's kind?

To locate cooperation barriers, to open doors to cooperation and to push further to minimise unpreparedness and risk levels

* There are various risks that we might have to face in our region in the near to long-term future. At this point, we decided to start assessing the following six: Storm; Forest Fire; Flood; Pandemic Flu; Accident at Sea; Nuclear Accident.

Here are the types of questions we asked ourselves in workshops and expert groupings

Fourteen Point Three Notebooks

Collection of Fourteen Point Three Notebooks is Set to Launch a CIRCULAR LOOP in which ONE PART Manifests The Whole and THE WHOLE Manifests One Part →

Task C ↔ **Macro-Regional Risk**

What will it take for us to have a common approach to risk and a common method to assess it? Do we need it? Why?

→ RED BOOK ONE / TWO →

... Red Books represent the contribution from our Task C experts whose main concern centred on beginning a discussion on the risk-assessment challenges in the Baltic Sea Region; a discussion that, for the first time, would include all countries from the area. In their two Notebooks they bring to us an insight on how our countries meet the challenge of assessing overall risk. They also question and explain what methodology can be used together, and they bring us their first attempt to develop a common language by drawing six different risk scenarios.

Task D ↔ **Floods**

How can we best share our experience in coping with floods? Could this help us to reduce the national costs associated with flood prevention, preparedness and response?

→ BLUE BOOK ONE / TWO →

... Blue Books represent the outcome from the Task D Grouping who have discussed flood prevention practice in the Baltic Sea region. Floods are an annual occurrence for most of the countries in our region, and each one of them has developed a strong national know-how of coping with this type of emergency. However, the discussions focused on how can we increase the effectiveness of our actions in dealing with this emergency by sharing experiences of individual singular-country specific cases? The Blue Books give us a picture of various flood prevention experiences in the Baltic Sea region, as well as their conclusions and recommendations for further know-how sharing.

Task E ↔ **Forest Fire**

What fire risk models are used already in the Baltic Sea region? How can these be bolstered? What kind of common system would we need and why?

→ GREEN BOOK ONE / TWO →

... The Green Books focus on our regions foliage, vegetation and forest cover and what happens when fire occurs. As our Task E experts discovered, all countries that participated in the work of Task E have their own national fire risk systems. These systems are both, similar and different at the same time. The question asked of experts was whether the region needs to have one fire risk system for the whole region? What would that system entail and how would that system borrow elements from other systems already developed elsewhere? This is to be decided in the future. For now, we have made a first step in this process providing you with an overview of existing fire risk systems in the Baltic Sea region.

Task F ↔ **Nuclear Accident**

Would we be able to cope with a nuclear emergency which would impact several countries in the region? How can we create a common response and alertness mechanism?

→ ORANGE BOOK ONE / TWO →

... Our Orange books investigate nuclear accidents The nuclear question is probably one of those regional questions which we cannot afford to overlook in a macro-regional context judging by its potential impact. To show you why this is so, Task F experts developed a scenario for an hypothetical accident in Finland that may have severe consequences on other countries in the region. The second part of their task work was to assess this developed scenario and provide recommendations for further activities that would increase our preparedness towards accidents of this complex kind. The scenario and workshop report are both delivered to you in our Orange Books completing the circle.

The EUSBSR flagship project 14.3 was a novelty on various levels

Two of the most important 'firsts'

...partnership of diverse civil protection actors from every country of the Baltic Sea region was built

...the focus of the project was concentrated on an all-hazards approach through a macro-regional lens

The questions we asked ourselves were

How can we acknowledge and communicate the project's complexity, and capture it without reducing or subordinating it at the same time?

How can we talk about the methods and the substance of inquiry at once, whilst keeping both on an equal footing?

Orange Book One brings you a nuclear accident scenario that was developed starting with an inquiry into what nuclear accident could potentially occur happen in the Baltic Sea region that, even if having started in one country, would immediately affect its neighbours and, consequently, the whole region. This scenario of a nuclear accident that occurred in Finland and then spread to other countries, was the first nuclear scenario developed by the Baltic Sea region experts from Nuclear Safety authorities that had macro-regional impact as its main foundation. →

Task F Fact Sheet

18 Months of...

MEETING →

Helsinki → Stockholm → Helsinki

The Task was led from Helsinki, Finland

WORKING →

Finnish Radiation and Nuclear Safety Authority (STUK) – Ministry of Interior, Finland – Helsinki City Rescue Department – Finnish Meteorological Institute – Finnish Government Security Services – Main School of Fire Service (SGSP), Poland – Federal Ministry of the Interior, Germany – Radiation Protectiaon Centre, Lithuania – Norwegian Directorate for Civil Protection DSB

Task F work was endorsed and supported by the Council of the Baltic Sea States Expert Group on Nuclear and Radiation Safety (CBSS EGNRS)

SHARING experiences →

(Core Group of Experts)
Juha Rautjärvi, Martti Annanmäki, Jorma Sandberg, Juhani Lahtinen, Roy Pöllänen, Raimo Mustonen, Pekka Visuri, Timo Härkönen, Janne Koivukoski, Simo Wecksten, Ville Estlander, Mikko Jääskeläinen, Eero Kytömaa, Minna Rantamäki (FI) – Peer Rechenbach (DE) – Kristina Mikalauskiene (LT) – Tone D. Bergan (NO) – Marcin Smolarkiewicz (PL)

JUHA RAUTJÄRVI Task F Leader:

"There are agreements to cooperate in case of major disasters. In terms of nuclear and radiation safety, there are regional forums, ongoing exercises. But the idea of risk *there* isn't addressed as a macro-regional concept.

We need to build a macro-regional approach because the complexity and scale of risks such as the one we investigated in the hypothetical Task F scenario can only be coped with on a macro-regional level. How to deal with it in the most efficient; i.e. cost-effective way – we just don't know yet. Therefore we need a new methodology – macro-regional methodology. Which would be as dynamic as the ever changing threat and risk itself. This can only be done by thinking in macro-regional terms, and the Baltic Sea region can be a pioneer in this."

TASK F Gave Us

→ The first case of a macro-regional nuclear accident risk scenario for the Baltic Sea region.
→ A study of this scenario that in turn provides us with concrete recommendations on how to move further.
→ An initial gap identification of our preparedness to cope with a macro-regional nuclear accident and its associated risks.
→ The first precedent in the Baltic Sea region by way of defining nuclear risk and associated preparedness gaps in terms of a macro-regional hazard and macro-regional response.
→ A foundation for integrating a macro-regional approach into ongoing processes of nuclear and radiation safety cooperation and experience exchange in the Baltic Sea region.

Macro-Regional Nuclear Accident Risk Scenario for the Baltic Sea Region[1]

1 This scenario was developed within Task F, with contribution from experts: Roy Pöllänen (Environmental monitoring, Security technology, Research); Jorma Sandberg (Risk assessment and analysis); Juhani Lahtinen (Environmental Monitoring and Emergency Preparedness)

Background Information on Nuclear Power Plant Safety

Nuclear Power Plants (NPPs) require cooling also when shut down.

Interruption of the cooling may result in the release of radioactive substances in the environment and, in the worst case, in health effects and restrictions on land use.

Exceptional environmental conditions would pose a challenge to ensuring the safety of nuclear power plants and the safety of the population of the neighbouring areas.

In nuclear reactors, thermal power is produced in neutron-induced fission reactions of uranium nuclei.

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As in conventional thermal power plants, thermal power is used to produce steam for the turbines. Steam can be produced in the reactor vessel (Boiling Water Reactor, BWR) or in the secondary cooling circuit (Pressurized Water Reactor, PWR).

In the fission reaction, a heavy uranium or plutonium nucleus is split into two medium heavy nuclei.

↓

Most of these fission products are radioactive and they decay with time into stable nuclei and emit ionizing radiation in the process. Radioactive fission products are cumulated in the nuclear fuel (reactor core) during operation of the nuclear reactor.

When a nuclear reactor is shut down, the fission reactions stop, but radioactive fission products remain in the nuclear fuel.

↓

Radioactive nuclei decay spontaneously and emit ionizing radiation which is harmful to living organisms. Therefore the radioactive materials must be isolated reliably from the environment. The radioactive materials are bound in ceramic uranium dioxide fuel which is in addition enclosed in leak tight metal cladding tubes (fuel rods). The reactor and primary cooling circuit is enclosed in a leak tight containment building.

The radioactive decay of the fission products produces energy (residual heat) which heats the nuclear fuel.

↓

Therefore a shut-down reactor requires cooling. If the necessary cooling of the nuclear fuel is lost completely or interrupted, the fuel heats up, the fuel cladding ruptures and the fuel finally melts. When the fuel becomes overheated or molten, radioactive substances are released from the fuel.

An accident leading to melting of a significant part of the reactor core will cause a severe reactor accident.

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In the long term, the "leak-tightness" of the reactor containment mechanisms may also be impaired or dangerously weakened and radioactive substances may be released to the environment.

The cooling of the nuclear fuel may be compromised due to failure of the cooling systems or due to the reduction of the cooling water due to a pipe breakage or other leak.

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Nuclear power plants are equipped with multiple emergency cooling systems and sources of operating power. The emergency cooling chains remove heat from the nuclear fuel to seawater or to the atmosphere. Some reactors are equipped with systems for severe accident management to ensure the integrity of the containment also after a core melt accident.

The distinct safety systems are designed so that they can initially handle accidents automatically, but later actions by the operating personnel are required.

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In the long term accident situations, nuclear power plants need off-site assistance, for example, personnel, fuel for emergency diesel generators, other supplies and heavy equipment.

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External Hazards and Nuclear Power Plant Safety

Extreme external events are considered in the design of nuclear power plants, and the safety systems are designed so that they can be operated in severe environmental conditions. The effects of extreme external events on a nuclear power plant may be quite complex.

Below some background information related to the suggested exercise scenario is given.

External events can affect nuclear power plants in several ways.

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Typically, in extreme external conditions a shutdown of the reactor would be required due to conditions exceeding some operational limits. In this case the safety systems would get their operating power from the external power transmission grid. If the grid connection were also lost due to the external event, on-site emergency power sources (diesel generators) would be used. Therefore it is important to ensure the operational service of the back-up emergency diesel generators or other alternative power sources in case of harsh weather conditions and other extreme external conditions.

Earthquakes →

Earthquakes can cause mechanical damage, for example, to cooling systems, power supply systems and to buildings. In the Baltic Sea region damaging earthquakes are considered extremely rare.

Impurities in the seawater →

Impurities in the seawater (algae, mussels, ice, oil) can a cause blockage of cooling water intakes. This risk has been somewhat decreased with alternative cooling water intakes. In addition, emergency heat removal systems have been designed to operate some time without seawater cooling (a few hours to a few days).

Flooding due to high seawater level →

Flooding due to high seawater levels may result in the malfunction or complete loss of emergency cooling systems or their power supply.

Exceptional storms, snowstorms and thunderstorms →

Exceptional storms, snowstorms and thunderstorms can damage the external power transmission grid. In this case the on-site emergency diesel generators or near-by reserve power plant can be used to supply electricity to the safety systems. Exceptional snowstorms can also endanger combustion air intake of the emergency diesel generators and cooling air intake of air cooled safety equipment.

Extreme low and high temperature →

Extreme low and high temperature may also cause disturbances to the external power transmission grid or to the safety systems and cooling systems. Cold weather combined with a long term loss of the external power transmission grid could lead to loss of interior heating and freezing of safety related piping.

Electric disturbances due to lighting →

Electric disturbances due to lighting are a potential reason for the loss of the external power transmission grid and failures of the safety systems, but the external power grid and nuclear power plant safety systems are well protected against lightning.

The possible combinations of external events are considered in the design of nuclear power plants.

In many cases the extreme external events are correlated, for example, in the event of an extreme storm, the Baltic Sea can reach exceptionally high water levels. Extreme events that occur simultaneously can endanger different safety systems at once leading to a set of complex interactions which will need to be tackled.

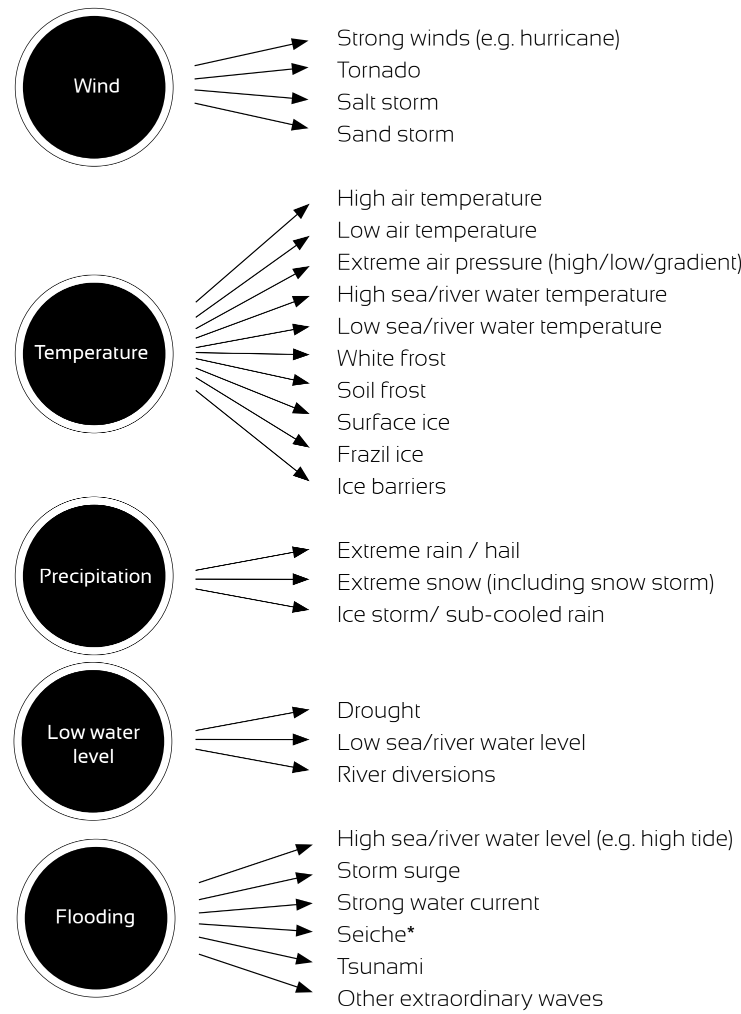
Extreme external events can also affect communications and access to the plant and impede management of the accidents at the plant and rescue operations in the neighbourhood. For example flooding, extreme snow fall and trees felled by a storm or tornado might block access to the site. If combined with a long term regional loss of the power transmission grid and communications network, clearing the highways might be take an unusually extended time. Ensuring the access of personnel, fuel and equipment to the site under these conditions may require actions by the rescue services in addition to the power utility.

2 NEA/CSNI/R (2009) 4. Probabilistic safety analysis (PSA) of other external events than earthquake. March 2009. (The Nuclear Energy Agency (NEA) is a specialised agency within the Organisation for Economic Co-operation and Development (OECD) Committee on the Safety of Nuclear Installations (CSNI) www.oecd-nea.org/nsd/csni)

List of Identified External Hazards of Nuclear Power Plants

There may be several possible off-site external events, but many of them are unrealistic in the region (Finland) due to their low occurrence probability. The following table lists some external hazards adapted from the NEA/CSNI report [2].

Natural Hazards



*A wave that oscillates in lakes, bays, or gulfs from a few minutes to a few hours as a result of seismic or atmospheric disturbances

Natural Hazards

- **Geology** → Seismic events; Land rise; Soil shrink/swell; Landslide; Under-water landslide; Coastal erosion; Avalanche
- **Lightning (electrical storm)** → Lightning
- **Meteorites** → Meteorite
- **Volcanic** → Volcanic phenomena
- **Biological** → Animals; Organic material in water; Other biological impacts
- **Chemical** → Corrosion (e.g. from salt water)
- **Fire** → Forest fire; Other external fire

Direct Man-made Hazards and Disruptions

- Direct impact from ship collision
- Radioactive releases
- Explosion [a]
- Civil unrest and demon-stration
- Electro-magnetic disturbance
- Satellite crash
- Airplane crash
- Excavation work
- Missiles from military activity
- Missiles from other installations
- Solid or fluid impurities from ship release
- Chemical release to water
- Fires including the impact of smoke on the plant [b]
- Chemical release [c]
- Ground vibration [d]

a) after transportation accident, pipeline accident, or industrial accidents

b-c) after transportation accident, pipeline accident, or industrial accidents

d) due to nearby explosions

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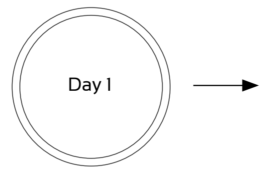
Overall Description of the Scenario and Background Data

Weather data

The weather situation and its incremental evolution described here should be taken as one specific weather scenario. It is probably unlikely but possible.



The scenario is built around the onset of an extreme winter storm. Extreme winter storm in Finland caused by an extended low-pressure area in the Baltic Sea area. The route of the low-pressure area is from Denmark towards the Kola peninsula (Fig. 1).

- In southern Finland and in the northern parts of the Gulf of Finland the wind first gusts in the southwest but turns to blow from the west.
- Wind speed exceeds the design basis of the main power transmission lines (> 39 m/s in three-second gusts).
- High (> +2 m) sea water level in the Gulf of Finland.
- Heavy snow fall (wet snow, precipitation > 100 mm/day in water).
- Temperature around zero.
- Just after the storm there is no ice in the Gulf of Finland.

It can be assumed that the strength of the winter storm came as a surprise to the meteorologists. Thus, necessary warnings were not given in due time, which partly explains the severity of the consequences described further below.

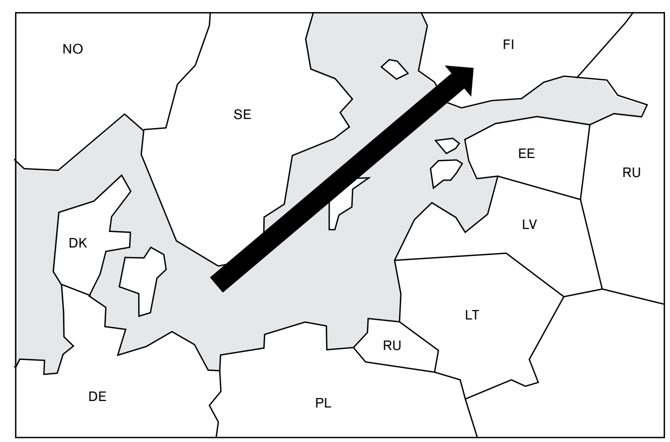


Figure 1 Low pressure area with a strong winter storm enters Finland after passing over the southern parts of the Baltic Sea region. The storm lasts one day.

Day 2 to a couple of weeks →

After the heaviest storm (1 day from its beginning) the temperature decreases rapidly in a day or two below -20 °C because of a large high-pressure area approaching from the west that brings cold air (Fig. 2) from the north.

The high-pressure area moves very slowly and stays over southern Finland and the near-by area for about two weeks.

- The wind turns to blow from the northwest and then it changes direction gradually so that at the end of the period it blows from the south-southeast or east.
- The wind speed is very low during the first four days after the storm.
- Sea ice forms rapidly because of the decreasing air temperature.

From a couple of weeks onwards →

The weather situation in Northern Europe and the Baltic Sea region countries changes to one of a rather "normal condition", i.e. interchanging moderate low and high pressures with accompanying rain/snow or sun. The overall effect is that all possible release of radioactive substances will disperse and cover more areas however with reduced concentration.

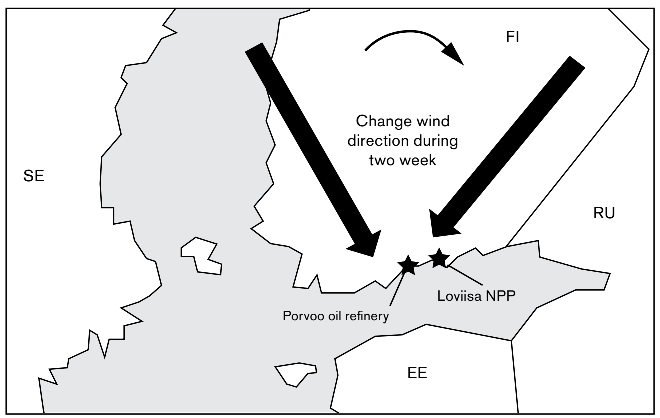


Figure 2 After the winter storm wind changes rapidly and brings cold high pressure air from the north. The high pressure area remains over Finland and nearby territories for about two weeks, during which time the wind direction changes gradually from northwest to northeast. The wind is much weaker than during the preceding storm, especially during the first four days.

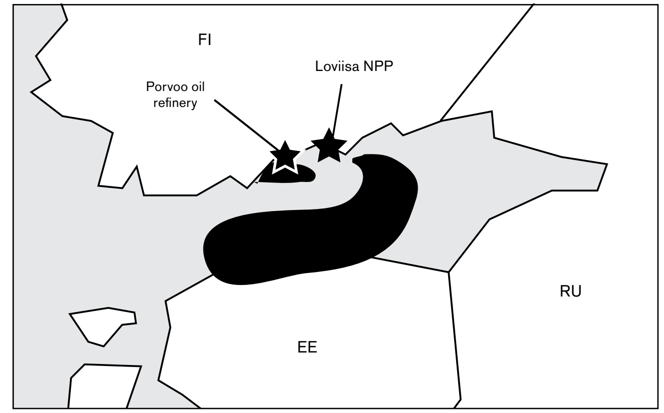


Figure 3 Dispersion of oil release from both accidents in the sea. The minor release is due to the fire at the Porvoo oil refinery and the major one is caused by the collision of an oil tanker and a cargo ship close to the Loviisa nuclear power plant (NPP). The figure represents the situation after a week or so. Note that the dispersion depicted here is forced by the wind, not by the sea currents.

Consequences

Off-site infrastructure and other related events

→ Major damage of the national transmission power grid.
→ Long-term (several days) electrical blackout in southern Finland caused by the storm.
→ Extensive blockage of roads (snow, ice, flood, trees, vehicles and other debris).
→ Severe damage to telecommunication facilities.
→ Loss of heating capacity of dwellings and other buildings.
→ Flaming fire in the Porvoo[3] oil refinery and oil leak to the sea causing a water intake hazard to the Loviisa nuclear power plant (NPP) during the winter storm.
→ Collision of an oil tanker with a cargo vessel nearby the Loviisa NPP lead to a massive oil leak to the Gulf of Finland. In the beginning, the oil slick is transported towards Loviisa NPP, but a few days later the slick starts to moves towards Estonia (Fig. 3).

3 Porvoo is a city and a municipality situated on the southern coast of Finland approximately 50 kilometres east of Helsinki. The Porvoo oil refinery came on stream in 1965. Three new process units have been built in the 2000's. It has an annual crude oil refining capacity of approximately 9.8 million t/a (206,000 bpd).

Loviisa[4] nuclear power plant data description

- Long term loss of off-site power (all connections).
- Some emergency diesel generators operational, but problems due to heavy snow fall (blockage of air intake).
- Damages requiring operation personnel actions in difficult conditions.
  - Very slow flooding at the plant through basement drainage.
  - Wind, snow, flying objects, darkness, low air temperature, radiation.
- Diesel fuel oil is running out in a few days.
- Fuel damage in one of the units after four days of the loss of the external power.
- Radioactive material release (1d release of radioactivity) into the sea and to outdoor air soon after the fuel degradation.
- The other unit is undamaged but requires cooling and diesel fuel supply.
- High-volatile and gaseous radioactive materials are first transported by air towards North West Russia and Eastern Estonia and later all over the Baltic Sea region (Fig. 4).
- The amount of the released material into the air and its radionuclide composition is approximately the same as in the Fukushima accident.

The concentrations of radioactive materials in sea water are approximately the same as reported in the Fukushima accident (movement is visualized in Fig. 5).

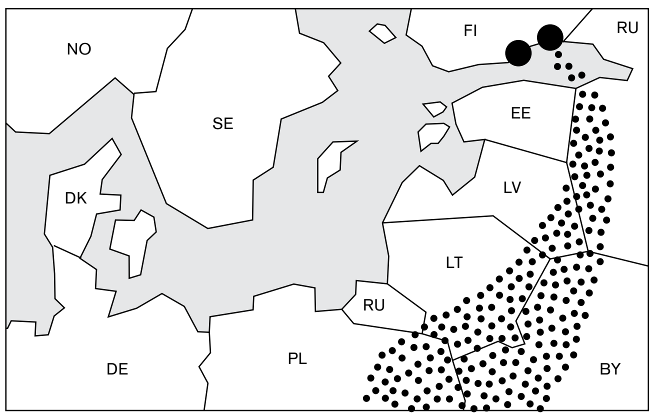


Figure 4 Approximate area affected by the radioactive cloud at three -four days after the particles initial release. After a couple of more days the cloud will also reach Germany, Denmark and the southernmost parts of Sweden and Norway depending on the wind and dispersal/weather conditions.

4 Loviisa is a municipality and town on the Southern coast of Finland. It is the site of two of Finland's nuclear reactors, two VVER units each of 488 MWe, at the Loviisa Nuclear Power Plant (NPP). The reactors at Loviisa NPP went into commercial operation in 1977 and 1980 respectively.

Resources

- Rescue services will be overloaded.
- All maintenance personnel at the Loviisa nuclear power plant and at various infrastructure facilities will be overloaded.
- There may emerge various security problems.

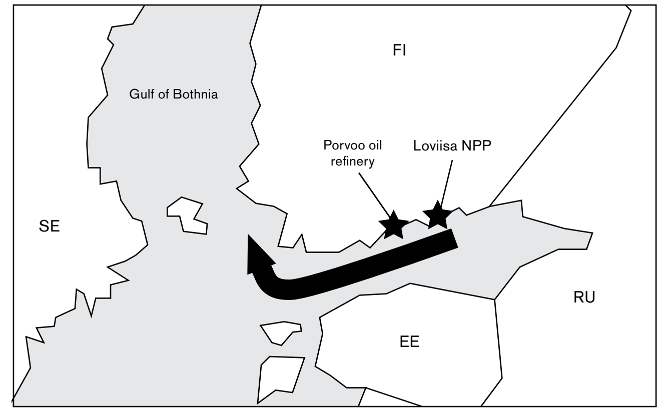
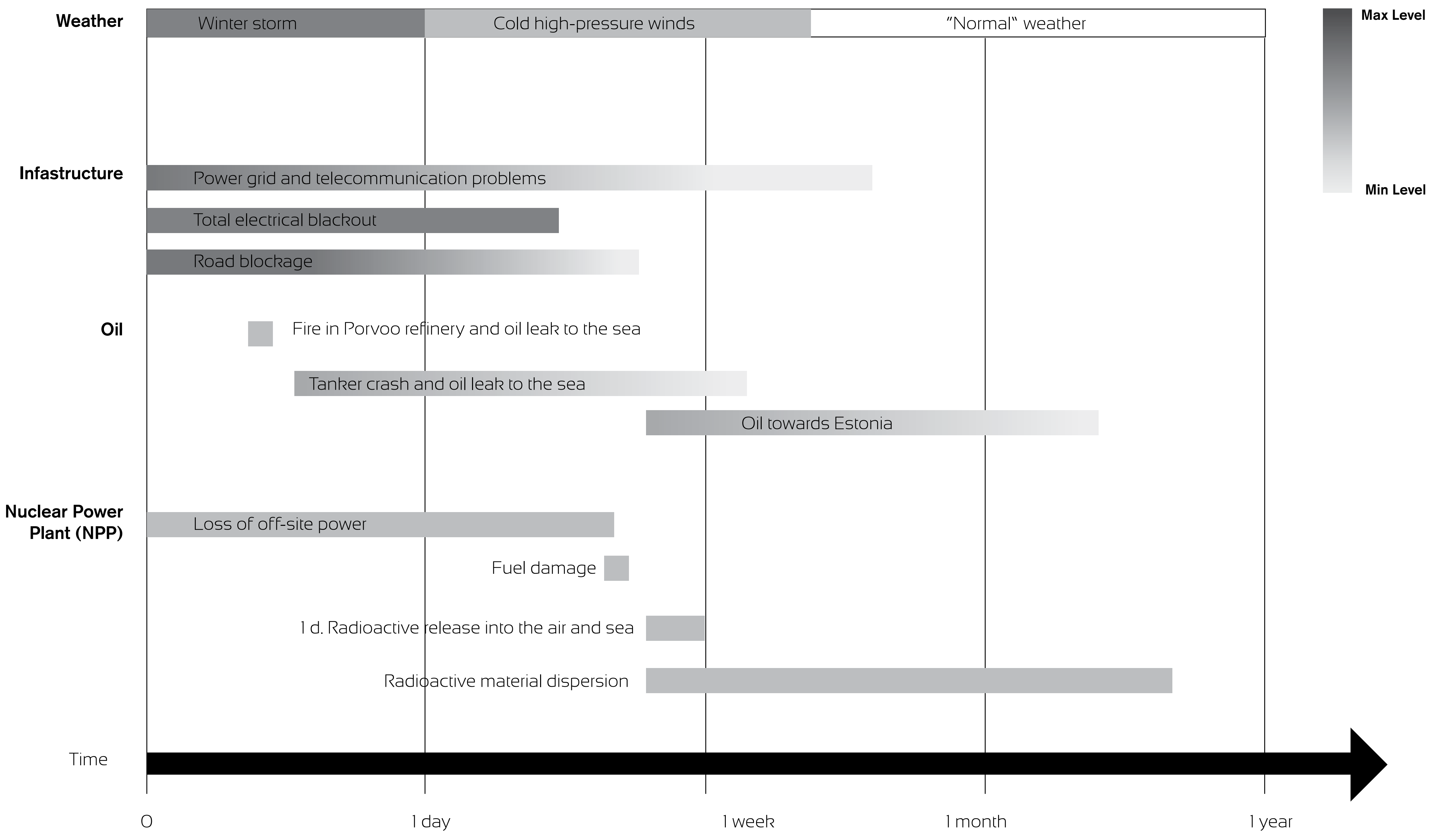


Figure 5 Movement of radioactive substances released directly to the sea. The Gulf of Finland has a counter-clockwise water current that flows into the Gulf of Bothnia (thick arrow) which also has a counter-clockwise current. The speed of the current at the surface is 0 1 kilometres per hour. For the scenario purposes one can assume that at the western part the Gulf of Finland a small part of the release is forced by the wind to move to the southwest (thin arrow) where it is captured by a current flowing towards the island of Gotland and the Swedish east coast.

Timing of major events/incidents



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This publication was conceived as part of the EU Strategy for the Baltic Sea Region EUSBSR Flagship Project 14.3 (January 2012 – June 2013); the project aimed to develop macro-regional risk scenarios and, based on their analysis, to identify capacity gaps in Baltic Sea region preparedness to cope with potential risks on macro-regional level.

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Project partners

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Finnish Radiation and Nuclear Safety Authority (STUK)
Hamburg Fire and Rescue Service (Germany)
State Fire and Rescue Service of Latvia
Fire and Rescue Department under the Ministry of the Interior of the Republic of Lithuania
Norwegian Directorate for Civil Protection and Emergency Planning (DSB)
The Main School for Fire Service in Warsaw (SGSP)
Swedish Civil Contingencies Agency (MSB)
Swedish Institute

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