Red Book Two

Guiding and Tailoring Risk Assessment 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 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 the 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.

Red Book One and Two bring you the outcome of the work of Task C. The former introduces readers to our endeavour to bring together national risk perspectives of the Baltic Sea region countries and in this way to map common risks that could affect the region as a whole, as well as to identify gaps by working systematically and using a common theoretical platform. This platform (or the process of establishing it) is precisely the outcome presented by the Red Book Two. On the one hand, it resulted from the process defined in the previous Notebook, and on the other hand, it became a defining text that will guide any future macro-regional risk assessment in the Baltic Sea region. As one could suggest, it was inspired by the EU Risk Assessment Guidelines, yet it is what we would like to call 'site-specific', i.e. tailored for our macro-region. In this sense the Notebook you are reading brings to you an historic document – the first time that a set of macro-regional risk assessment guidelines were suggested, formulated, and circulated in the macro-regional civil protection discourse. From now on, macro-regional risk related discussion in the Baltic Sea region will nevermore have to take off from a non-defined position. It's becoming and path have been documented.

It is our pleasure and honour to be sharing with you this vision of cooperation through our Red 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.

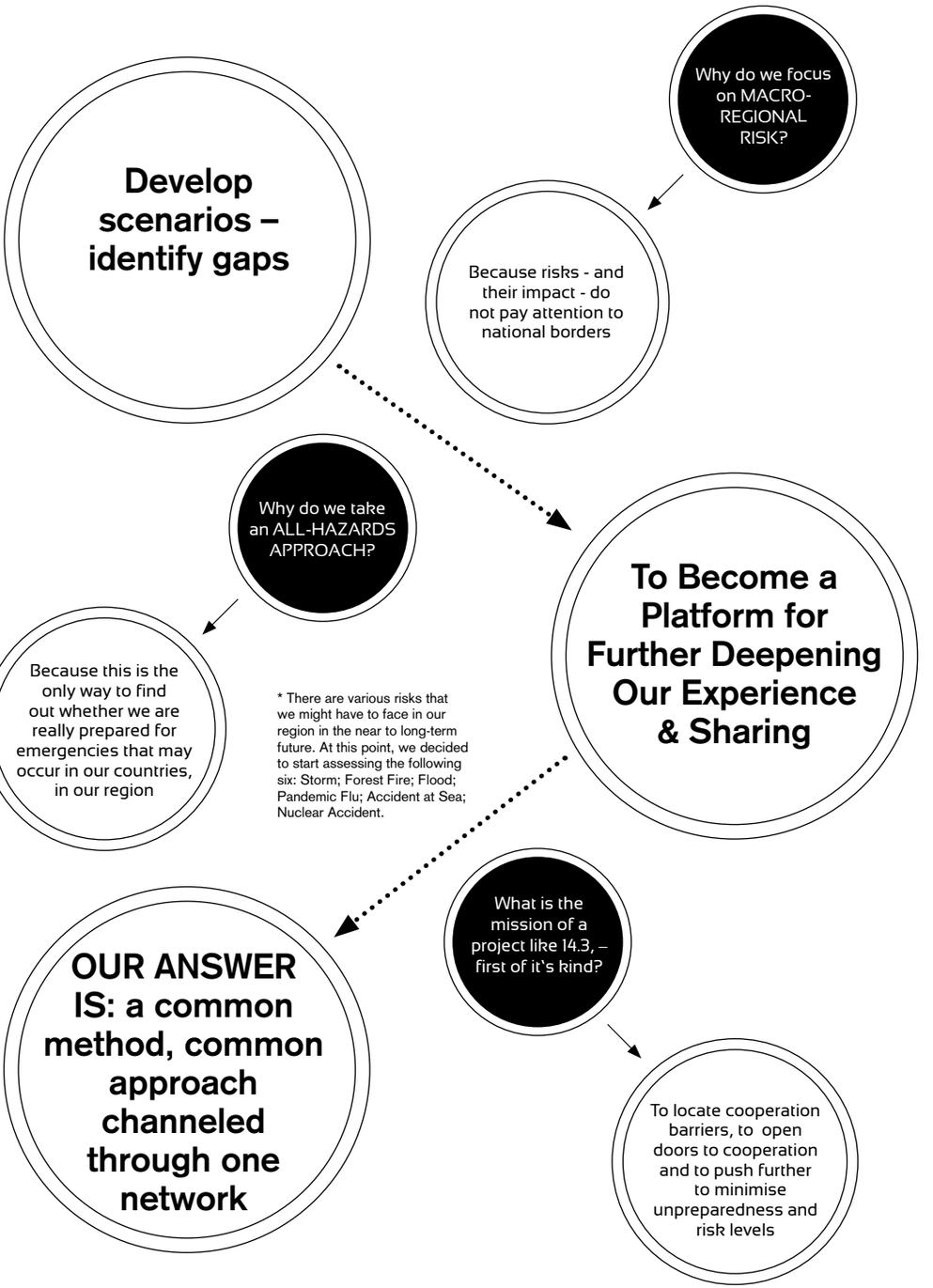
This was especially visible in how the all-hazards approach had to be adopted for the project. All-hazards approach is a challenging claim even on national level, as it requires crossing administrative and institutional boundaries. Which is the best way to achieve this? The answer is yet to be formulated.

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*



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

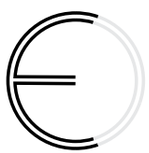
Task D

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?

GREEN BOOK ONE / TWO

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?

BLUE BOOK ONE / TWO

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

... 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.

... 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.

... 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.

... 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?

Red Book Two will guide you through a process of assessing macro-regional risk. It presents you the methodological framework that needed to be conceived in order to make the first step towards a macro-regional risk assessment in the Baltic Sea region. We would say that in no small sense and from a multi-national perspective this is pioneering →

Task C Fact Sheet

18 Months of...

MEETING in the Baltic Sea region →

Stockholm → Hamburg → Riga → Warsaw → St Petersburg

The task was led from Tønsberg, Norway

WORKING together →

Norwegian Directorate for Civil Protection and Emergency Planning (DSB) - Fredrikssund-Halsnæs Fire & Rescue Service (Denmark) – Estonian Rescue Board – Main School for Fire and Rescue Service in Warsaw (Poland) – Swedish Civil Contingencies Agency (MSB) – State Fire and Rescue Service of the Republic of Latvia – State Fire and Rescue Service of the Republic of Lithuania – Hamburg Fire and Rescue Service (Germany)

SHARING experiences →

(Core Group of Experts)
Tone D. Bergan, Janniche Cramer, Thomas A. Hansen (NO) – Kim Lintrup (DK) Kaido Tee, Jaan Eiken (Jaan Tross, Kady Danilas) – Martins Baltmanis, Ivars Nakurts, Rudolfs Azens (LV) – Taito Vainio (FI) – Svetlana Krasilnikova, Giedrius Viganauskas, Neringa Brogaite-Karveliene (LT) – Jerzy Wolanin, Pavel Kepka, Marcin Smolarkiewicz – Jürgen Krempin, Marko Florek, Simon Reif (DE) Carl-Gustaf Erixon, Ole Florin (Tiina Saksman Harb, Magnus Winehav) – Michael Galishev, Dmitry Umanets (Consultants: Mats Ruge Holte (NO) and Pekka Visuri (FI))

TONE BERGAN Task C Leader:

"It is challenging to build up a macro-regional risk approach. Most countries in our region are still developing their own national risk assessments and we found out that we speak very different languages. We use different terms, there are many authorities involved and even within each country exist challenges of having different authorities communicating and cooperating one with another. Then we move across the border and another dimension is added. 14.3 project, I think, is one step ahead in establishing a way towards how to deal with these challenges."

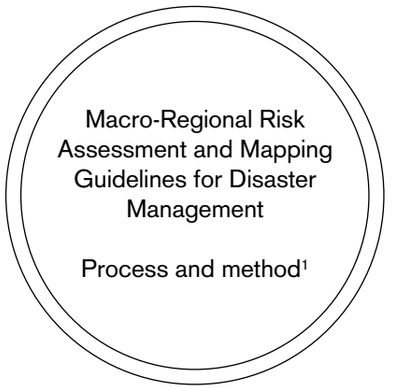
TASK C Gave Us

→ Six scenarios for hazards that may have cross-border and/or macro-regional impact.

→ Scenarios help us to make sure that we have planned for which troubling effects we have to be prepared for.

→ Macro-Regional Risk Assessment and Mapping Guidelines for Disaster Management Guidelines can be a vocabulary for civil protection experts, to make sure one 'common language' among different countries is used.

→ An open door to build a common understanding on what assessing macro-regional risk in the Baltic Sea region can bring. It helps to make sure that you can receive help from other countries should you need it, as well as for you to be prepared to help the others.



1 The methodology and process document has been developed within Task C by the core-group: Carl-Gustaf Erixon, Tiina Saksman Harb and Ola Florin (Swedish Civil Contingencies Agency - MSB) and Mats Ruge Holte, Janniche Cramer, Thomas A. Hansen and Tone D. Bergan (Norwegian Directorate for Civil Protection and Emergency Planning - DSB). The initial document was based on Swedish and Norwegian experience with developing a National Risk Assessment, and modified to accommodate a macro-regional approach. Modifications have been made, based on inputs and comments from the EUSBSR flagship project 14.3 Task C participants.

Background

Our task consists of mapping macro-regional risks and hazards in the Baltic Sea region

The approach is based on the EU Guidelines for Risk Assessment and Mapping (Commission staff working paper, 21.12.2010 SEC (2010) 1626 final). European Commission developed these guidelines in order to facilitate a coherent method of hazard and risk mapping, assessment and analysis among Member States. All Member States were invited, before the end of 2011, to further develop approaches and procedures to risk management, and to make use of the guidelines on methods of risk assessments and mapping.

Each nation is required to have an overview of risk and vulnerabilities within their own territory

Risk and vulnerability analyses are important tools to this end. However, there are significant variations between the different sectors and different nations in how they carry out risk and vulnerability analyses. Some risks and hazards do not consider national borders as a barrier, and may create needs for both international cooperation as well as international assistance. Thus, a need for a systematic approach to risk assessments has been identified to enhance civil protection and emergency planning.

Task C of the EUSBSR flagship project 14.3 aims at further developing the EU guidlines –

so that they can be implemented on a regional basis, providing a macro-regional risk assessment. A uniform framework for mapping and comparing risks posed by different types of hazards will be prepared. The mapping will be based on available national risk assessments. The identified risks will then be compared according to a uniform methodological framework.

The objective of a macro-regional risk assessment is to provide a common ground for civil protection and emergency planning

Attention is primarily directed towards events with serious consequences and where extraordinary efforts by the national authorities as well as in neighbouring countries are required. Dialogue and discussions across sectors and disciplines contributing to a common understanding of the challenges the Baltic Sea region faces is important, and represents an additional objective.

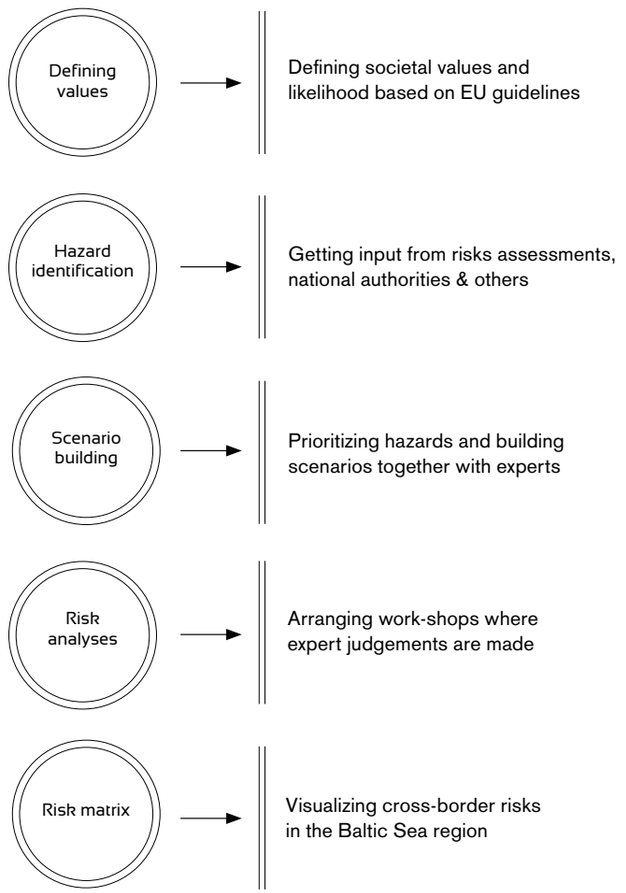
Close cooperation with responsible authorities is essential in the development of a macro-regional risk assessment

The methodical approach draws heavily on the work of the EU and the guidelines for national risk assessments. The initial survey carried out by the Task C working group in project 14.3 has, however, revealed that only a few participating countries have performed national risk assessment.

In this document the process and method used in the preparation of a macro-regional risk assessment is described. It is mainly meant as a guide to authorities in the Baltic Sea region who actively contribute to the work, but could also be of interest to other regions.

Main Steps in Risk Analyses

The approach to risk analyses varies between disciplines and sectors. In the process of preparing a macro-regional risk assessment, it is important that the actors have a common understanding of methods and how to carry out the risk analyses. Methodologically the macro-regional analysis for the Baltic Sea region is based on the EU's Guidelines for Risk Assessment and Mapping. There are five main steps in such an analysis. This chapter will give a brief presentation of those steps.



Step 1: Defining values

Macro-regional risk analysis (as defined during the project 14.3) is a collation of cross-border risks posed by different types of hazards in the Baltic Sea region. The concept "risk" is here defined as a combination of an accident's likelihood and its impact, i.e. consequences for the societal values implicit below.

An accident is an event that threatens societal values. Based on EU's guidelines, public reports and similar risk analyses conducted in other countries[2], the following impact areas are defined as threatening societal values:

- **Human impacts (number of affected people):** The number of deaths, the number of severely injured or ill people, and the number of permanently displaced people.
- **Economic and environmental impacts:** The sum of the costs of cure or healthcare, costs of immediate or longer-term emergency measures, costs of restoration of buildings, public transport systems and infrastructure, property, cultural heritage, etc., costs of environmental restoration and other environmental costs (or environmental damage), costs of disruption of economic activity, value of insurance pay-outs, indirect costs on the economy, indirect social costs, and other direct and indirect costs, as relevant.
- **Political and social impacts:** Usually rated on a semi-quantitative scale and may include categories such as public outrage and anxiety, encroachment of the territory, infringement of the international position, violation of the democratic system, social psychological implications, damage to cultural assets, and other factors considered important which cannot be measured in single units, such as certain environmental damage.

In risk identification and risk analysis all three categories of impact should be considered when assessing the impact of any analysed hazard, including for risk scenarios and multi-risk assessments.

Risk analysis also looks at the likelihood of different types of hazards. The likelihood analysis is a quantitative assessment. It is based on experiences with different hazards in the region, expected future developments and on qualitative expert assessments.

2 UK Cabinet Office "National Risk Register of Civil Emergencies 2010 ed." and Ministerie van Binnenlandse Zaken en Koninkrijksrelaties (the Dutch Ministry of the Interior and Kingdom Relations) "Working with scenarios, risk assessment and capabilities in the National Safety and Security Strategy of the Netherlands".

Step 2: Hazard identification

In the next step, threats and hazards that might strain fundamental societal values, and hence pose a regional risk, are identified. The identification is based on reviews of existing risk analyses and assessments, on other relevant documents, as well as on input from relevant stakeholders. In this step a selection of which hazards to analyse further is made, i.e. which hazards to develop into scenarios.

Step 3: Scenario building

Based on the hazard identification and hazard selection, scenarios are then created. Scenarios are a common and useful tool in risk analyses. They are used as a way of communicating about an uncertain future and obtaining a joint picture among participants in risk analyses.

The identified hazard, e.g. flooding of a specific region, constitutes the main event in the scenario. The scenario must also include information about what caused the top event, e.g. heavy rainfall over an extended period of time, the general context, e.g. geographical location, time of the accident, and indicate the types of consequences that are relevant, e.g. regional evacuation, destroyed power grids and so forth.

According to the EU guidelines a national risk analysis is based on so-called reasonable worst-case scenarios. This means that scenarios must be possible in principle – i.e. they could happen. In the EUSBSR flagship project 14.3, they must also have an impact on a national or macro-regional scale and require cross-border cooperation. They must be relevant for at least one of the impact areas.

The scenarios constitute the basis for the following risk analyses.

Step 4: Risk analyses

Risk analyses are carried out based on the selected incidents and their accompanying scenarios. The analyses of the scenarios are carried out in workshops, where a group of experts and authorities from various disciplines, sectors and countries participate and elaborate on consequence descriptions. These descriptions are based on consequence criteria within the three impact areas.

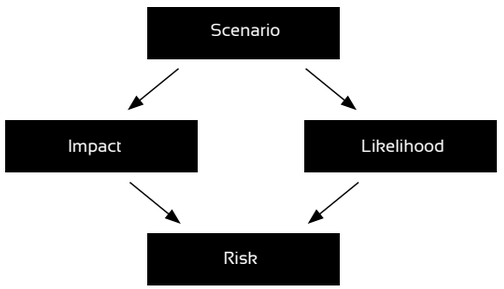
In addition, the likelihood of such an accident taking place in the Baltic Sea region over the coming five-ten years is evaluated. However, in such analyses the general focus is more on consequences as compared to assessing the likelihood.

Step 5: Risk matrix

The results from the various risk analyses are then collated in a risk matrix, where the various scenarios are placed according to their respective consequence and likelihood. The risk matrix is a visualisation of the results from the performed risk analyses.

Figure 2

Each scenario is assessed according to its impact and likelihood, and then all the scenarios are put into a risk matrix



Dealing with Uncertainties

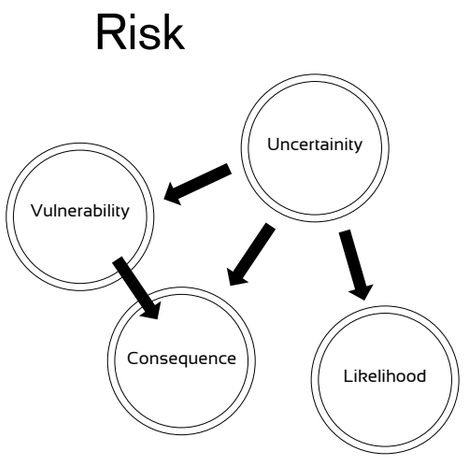
When assessing risk, uncertainty is an important element that must be taken into consideration. Scenario-based risk analyses are about future risks. Most types of events and phenomena which are analysed in a macro-regional risk assessment occur rarely or have never occurred. Hence, the knowledge base is limited. Consequently, there is reason to believe that the uncertainty in the risk assessment is fairly significant, and it is important that this uncertainty is communicated clearly.

As figure 3 shows uncertainty in risk analyses can influence on all parts of the assessment. Uncertainty might stem from several sources, including poor data quality and a lack of essential and reliable data. The degree of uncertainty depends upon the total state of knowledge at a given point in time. It is therefore important that all sources of uncertainty are identified – both data (epistemic) and model (stochastic) uncertainties, and described during the process.

Parameters that analysis is sensitive to should be clearly stated in the analysis. There are, however, a wide range of uncertainties. They include uncertainties that will influence what risks are measured and also how they are measured. Here are examples of situations where we lack knowledge, or where decisions made might alter the outcome of the analysis:

Figure 3

Uncertainties in risk assessments



- **Step 1 Defining values:** Are the variables and intervals used for measuring consequences relevant? Do they cover the desired outcomes? Do the criteria reflect the perception of risk in the societies concerned, and hence make a good foundation for the analysis? Do the criteria and the intervals reflect the societies' risk acceptance?

- **Step 2 Hazard identification:** Are the criteria used for deciding what hazards to look at relevant? Are the most relevant hazards identified and subsequently used in the analysis? Are there other hazards that should have been included? Are there other hazards where the combined risk is higher according to the impact criteria?

- **Step 3 Scenario building:** Are the scenarios created in a manner where they can be compared? Is there a consistent worst case logic in all scenarios? Are relevant criteria used when describing the different scenarios? Do the scenarios include the necessary parameters for assessing consequences?

- **Step 4 Risk analyses:** Do we have sufficient knowledge to assess the consequences? Are the relevant experts represented? Are the scenarios and criteria used for measuring consequence and likelihood understood in the same way by all the experts? Would a different set of experts conclude in the same way based on the given scenarios?

- **Step 5 Risk matrix:** Does the risk matrix reflect society's risk? Do readers of the matrix understand uncertainties involved in the process? Do they understand what can and cannot be read into the matrix?

All these uncertainties are relevant for the outcome of the risk analysis, but not all of them are easy to measure. However, all these uncertainties need to be taken into account when interpreting macro-regional risk. To communicate results efficiently they need to be understood both by the people sending and receiving the message.

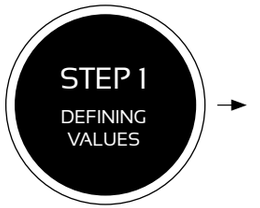
It is important to communicate uncertainties, particularly the uncertainties involved in Step 4 Risk analyses. Here experts, based on a given scenario and the established consequence criteria, define each hazard's risk. This analysis should rely as much as possible on empirical evidence and experience from past disaster data or established quantitative models of impact. For quantification purposes a number of assumptions and estimates will have to be used, some of which may be rather uncertain. These assumptions and estimates should always be clearly identified and substantiated.

Dealing with Uncertainties

Uncertainity	Explanation
High	It is difficult to make an assessment. There is a lack of relevant statistics and data within this field, and it is therefore a clear danger of making wrong assessments. The expert assessment is not well founded in evidence.
Medium high	An assessment can be partly made based on available statistics and data, but they are incomplete. The assessment is reasonable, but is not conclusive given the available knowledge. The assessment could be wrong.
Medium low	An assessment can be made based on fairly complete statistics and data. The assessment is reasonable. Although data is incomplete, there is experience to support the assessment.
Low	There is a large amount of experience, data and statistics available on the subject. There is always a danger that assessments are wrong, but in this case this is perceived as not likely.

Table 1 Criteria for assessing uncertainties involved in step 4 of the risk analyses

After each risk is analysed, e.g. after the expert groups have assessed and scored the scenarios, the uncertainties involved in the process should then be assessed. They should be assessed according to the criteria given above in table 1. These uncertainties should be reflected in the macro-regional assessment for the Baltic Sea region, and the expert group is asked to make comments on the basis for the uncertainty assessment and the most important factors in the assessment.



Baltic Sea Region Macro-Regional Risk Assessment

The first step in developing a macro-regional risk analysis for the Baltic Sea region is defining the impact areas. Here, the description of consequences/ cascading effects is vital. The expert group's assessments are structured according to a set of defined consequence criteria derived from the three impact areas.

Impact area	Consequence criteria
Human impacts	1.1 Fatalities 1.2 Injuries and illness 1.3 Number of people evacuated
Economic and environmental impacts	2.1 Infrastructure disruption 2.2 Damage to nature and the environment 2.3 Financial and material losses
Political/social impacts	3.1 Social psychological impact 3.2 Disruptions to daily life

Table 2 The three impact areas and the consequence criteria derived from these

In this macro-regional risk analysis the following impact areas and consequence criteria will be the basis for the analysis:

The criteria are defined into the three impact areas formulated in the EU Guidelines for Risk Assessment and Mapping. A more detailed description of the consequence criteria is given in appendix A. The expert group is free to describe consequences beyond these criteria, and is encouraged to do so as long as this can contribute to a more comprehensive risk analysis.

This is a macro-regional risk assessment, focusing also on cross-border effects. For each consequence criteria the cross-border effects should therefore also be analysed.

Finally, the likelihood of scenarios should be estimated. As with the consequences, the assignment of likelihood is based on expert assessments. The estimates reflect the likelihood of such an event to occur in the Baltic Sea region within the coming five-ten years.

The likelihood assessments will not be based on the specific scenarios and the consequences described therein, but are rather tied to more general types or categories of events, such as "flooding", "pandemic" and so on. The likelihood assessments are as such partially detached from the scenario and can be performed independently.

Assessing the likelihood of different types of events often requires different types of information and knowledge. However, all likelihood assessments will contain a significant portion of subjective and qualitative expert assessments at the core. All conditions which are considered to influence likelihood will therefore be relevant.

STEP 2
HAZARD IDENTIFICATION

In the second step of the process hazards that may affect fundamental societal values are identified. Society faces a wide range of various hazards. In order to identify and map these, a wide and inclusive process is necessary. Vital sources of information can be:

- Ministries and other national authorities
- International organisations
- Risk, threat and vulnerability assessments – macro-regional and regional
- Past accidents and projected changes
- Expert assessments
- Other relevant information

Risk-, threat- and vulnerability assessments can also be reviewed through available national risk assessments, relevant public reports and other supplementary information. The identification is based on reviews of existing risk analyses and assessments, on other relevant documents, as well as input from relevant stakeholders. The selection should, in the best possible way, illustrate the broad range of various types of events that may threaten fundamental societal values. Primarily, criteria for selecting events are that each of the particular events affects one or more of the impact areas, that the event will have cross-border impact and trigger the need for international assistance.

Additionally, consideration on a variation in conditions may shed light on the variety of challenges related to risk management, based on whether the events are “creeping” or “sudden”, whether they are local or global, to name just two opposing positions.

STEP 3
SCENARIO BUILDING

A risk analyses according to EU guidelines are scenario based, meaning that scenarios are defined as a detailed and specific description of an undesirable incident. A scenario is a description of a future condition and the series of actions and events leading up to the incident.

A general, but vital, guideline when designing scenarios is that these should represent “plausible worst case scenarios”, meaning that the described scenario should be very severe, but also seem credible. This implies also that the incidents are “low likelihood, high consequence”incidents, with little empirical data or statistics to assess the likelihood in any exact numerical or quantitative manner.

In order to evaluate particularly the consequences of a given scenario a number of conditions need to be described in the scenario. Conditions that are described in all the scenarios used in the Baltic Sea region macro-regional risk assessment are:

Scenario
- Geographical location
- Time
- Description (scenario)

Step 3: Scenario Building

Administrative consequences
- Warning /time for preparation
- Duration
- Affected areas
- Affected sectors
- Need for cooperation/coordinated crisis management

Consequences/cascading effects
- Human impacts consequences for basic needs
- Economic and environmental impacts
- Political/social impacts

The scenarios are, at a later stage in the process, scored according to the values defined in step 1 of the process, see also appendix A.

STEP 4
RISK ANALYSES

Based on the selected events, separate risk analyses for each of the scenarios are carried out. The analyses are carried out in workshops, where experts from various disciplines and sectors participate.

Risk assessments of various events require a wide range of expertise present in the workshops. However, due to logistical and other reasons, the number of participants, disciplines and sectors represented at these workshops needs to be restricted.

Experts with specific sector or system knowledge should be invited to participate in workshops when “their” sector or systems form the basis of the scenario. However, in order to ensure a comprehensive and uniform risk analysis it is necessary for some experts to participate in several workshops. Further refinement of the analyses will require a well-balanced and more expert oriented assessment.

STEP 5
RISK MATRIX

Based on the risk analyses, the working group prepares a risk matrix. The risk matrix is a collation of the results of the risk analyses carried out in the previous step of the process. The risk matrix is based on the two main components in the analysis; consequence and likelihood. For each scenario these two components are assigned a score from A to E. These categories indicate degrees of consequence and likelihood:

Category	Consequence	Likelihood
A	Low	Very low
B	Medium	Low
C	High	Medium
D	Very high	High
E	Catastrophic	Very high

Table 3 Consequence and likelihood categories

Step 5:
Risk Matrix

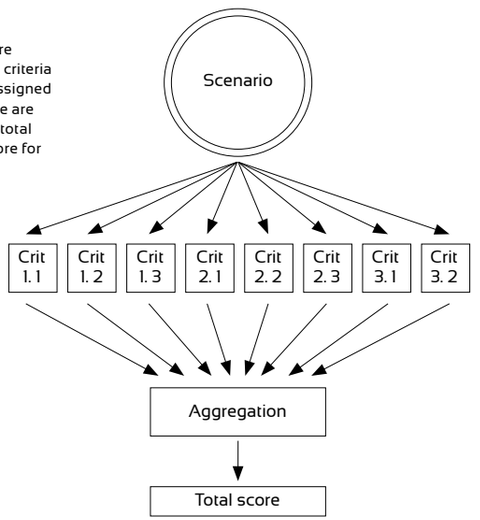
For an account of how a scenario is placed in their respective categories for consequence and likelihood, see chapter 4 Step 1 and appendix A.

Consequences: The consequences are described according to eight criteria, where each criterion is assigned a score ranging from A to E. The score depends on the magnitudes indicated in the risk analysis, e.g. number of fatalities, costs etc. A predefined model is applied for this purpose. For more detail see appendix A.

After assigning a score to all the criteria, the individual scores are aggregated to produce a total score for the scenario, see figure 4. Again a predefined model is applied which indicates how the score on each of the individual criteria are aggregated to a total score. For more details see:

Figure 4

Consequences are analysed using 8 criteria (Crit.). They are assigned a score, and these are aggregated for a total consequence score for the scenario.



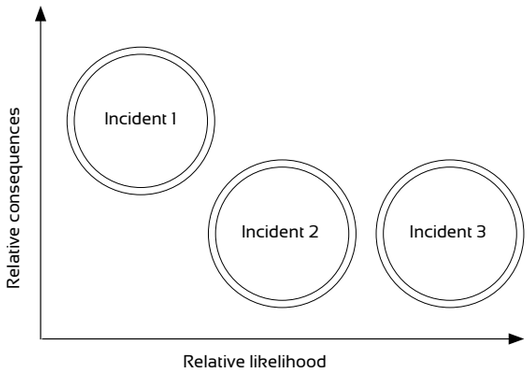
Likelihood: As with the consequences, the assignment of likelihood is based on expert assessments. If data is available, more detailed assessments of likelihood can be made, e.g. once per 200 years, or once per 50 years.

Collation: Through the above-mentioned approach, each scenario is assigned a score (A-E) for both consequence and likelihood. The scenarios are then collated, based on these scores, in a matrix, see Figure 5.

Step 5:
Risk Matrix

Figure 5

The matrix illustrates the likelihood of various types of events occurring within 5-10 years, and the consequences of the selected scenarios.



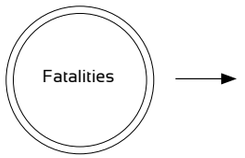
The placement along the likelihood axis is based on the likelihood of the scenario described occurring, while the placement along the consequence axis is based on the consequences of the scenario. Hence, the matrix demonstrates the likelihood of various types of events occurring in a 5-10-year period, and the consequences of these events.

In conclusion it is important to emphasize that the risk matrix only illustrates some of the results of the risk analysis – and that much relevant information will not be directly illustrated in the matrix. In order to get the full benefit of the knowledge that has emerged through the process, it will therefore be important to study the underlying information and assessments in connection with the various scenarios as well.

APPENDIX A

Calculating Score of the Various Consequence Criteria

Human Impacts

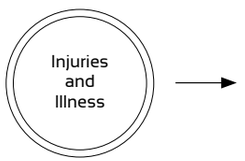


Fatalities directly caused by the incident and/or people with injuries that lead to a quicker death due to the incident. Direct fatalities include everyone who dies within a year due to the incident. An accelerated death includes all those who die within 20 years after the incident (due to this). Examples of events that can cause accelerated deaths include accidents at chemical plants, nuclear accident, etc.

The score is calculated based on the following variables:

- number of fatalities
- time of death

Number of people Time	<10	10-50	50-250	250-1000	> 1000
A – Direct (first year)	A	B	C	D	E
B – Accelerated (over the course of 20 years)	A	A	B	C	D



This category focuses on people who are seriously or very seriously injured, or who have serious illnesses due to incidents. “Very serious” is defined as all injuries and illnesses that threaten the patient’s life for a period of time. “Serious” is defined as injuries and illnesses that do not necessarily threaten the patient’s life, but requires treatment at a hospital and/or can cause permanent injury or prolonged consequential symptoms, such as amputation, burns, reduced or lost hearing and psychological trauma.

People who experience a reduced general health condition over a prolonged period (more than one year), meaning that they for instance are in need of medical assistance, that they are unable to work (or suffer a substantial reduction in their ability to work), or they experience limitations in social life, must also be included. Examples of relevant events could be terrorist attacks, epidemics/pandemics, industrial accidents, fires, etc.

The score is calculated based on the following variable:

- number of injured and ill

Number of people	<30	30-250	250-1000	1000-10000	> 10000
	A	B	C	D	E

The number of people evacuated from an area for more than a day as a result of the accident. Evacuated includes both people who evacuate voluntarily and as a result of orders by national or regional authorities. Evacuated also includes people who are permanently displaced.

The score is calculated based on the following variables:

- number of affected
- duration

Number of people Time	<100	100-1000	1000-10000	10000-100000	> 100000
< 3 weeks	A	A	B	C	D
> 3 weeks	A	B	C	D	E

Economic and Environmental Impacts

Infrastructure Disruption →

This category measures disruptions in critical infrastructures as a result of the accident. The result can be people not having access to clean water, food or heating, or to critical services such as health and social services, crises management and other important public services. Disruptions of critical infrastructure can lead to people not being able to attend work, go to school, etc. The following functions (vital services) and critical infrastructures should be assessed:

- Food distribution
- Water and sanitation networks
- Power transmission grid
- Electronic communication network (fixed and mobile)
- Oil and gas distribution
- (Public) transportation networks and hubs
- Rescue services
- Medical support and medical services

The score is calculated based on the following variables:
- number of variables affected
- duration

Loss of electrical power will influence many other functions in daily life, and loss of electrical power is therefore assessed separately.

Loss of electrical power	<1 day	1-4 days	4 days-2 weeks	2-4 weeks	> 4 weeks
Duration	A	B	C	D	E

Loss of other vital services

Number of variables affected Duration	1-2	3	4-5	6
< 1 week	A	B	C	D
1 week to 1 month	B	C	D	E
> 1 month	C	D	E	E

Damage to Nature and the Environment →

Long-term or permanent damage to nature and the environment, including pollution of the air, water or ground, as well as long-term or permanent disruptions to original ecological functions, such as reduced biodiversity in flora and fauna, loss of particular eco-systems, invasion of alien species, etc. The term “environment” also includes loss and/or permanent deterioration of cultural heritage assets, such as buildings, burial mounds, objects, environments and landscape characteristics. Examples of events which may cause long-term damage to nature and the environment could be oil spills, major fires, usage of biological or chemical weapons during terrorist attacks, etc.

Damage to Nature and the Environment →

The score is calculated based on the variables geographic scope and duration. In examples where the incident primarily causes long-term damage to inland environment (such as radioactive fallout), geographic scope is estimated as the area (square kilometres) of the affected area. In events where the incident primarily affects coastal environments (such as oil spills), the geographic scope is estimated as the length (kilometres) of the affected area. Duration is measured in years and is assessed as the time it takes from the damage occurs and until nature and the environment is fully returned to its original state, or in other words, when the situation has returned to normal.
The score is calculated based on the following variables:

- geographical area affected
- duration

Geographic scale (km2) Duration	< 30	30-300	300-3 000	> 3 000
< 1 year	A	B	C	D
> 1 year	B	C	D	E

Financial and Material Losses →

This category focuses direct costs due to the incident in the form of financial or material losses. This generally can be said to include costs that fairly easily can be priced in a market, in connection with damage to property, loss of business (commercial loses) and handling and restoration. Examples of events can include earthquakes, pandemics with subsequent significant absence due to illness, animal disease (such as foot and mouth disease), extensive failures in payment systems, etc.

The following cost indicators should be assessed:

Damage to property:
- Damage to buildings and infrastructure (clean-up costs and rebuilding value)
- Damage to fixtures and fittings, machinery, equipment, etc. (replacement value)

Health damage:
- Extra health care costs (hospital admissions, treatment, nursing expenses etc.)
- Costs of paying death compensations and premiums to relatives
- Extra costs of incapacity and relatives pensions (benefits and pensions)

Financial loss:
- Direct commercial loss due to damage to property and/or reduced labour force and/or damaged premises
- Indirect commercial loss due to a lack of demand or supply, problems with communication, transport, etc.
- Direct financial loss due to claims, fines, appropriation of property, etc.

Economic and Environmental Impacts

Financial and Material Losses →

Combating, handling and restoring:

- Costs in connection with use of operational services, emergency services, evacuation, etc. (total cost of operational services)
- Clearing costs and reparation costs due to damage to nature and the environment (cost of using repair workers)

The score is calculated based on the following variables:

- the combined sum of the indicators described above

Costs (Euro)	5-50 mil.	50-500 mil.	0.5-5 bn.	5-50 bn.	> 50 bn.
	A	B	C	D	E

When assessing costs in different countries, it might be useful to express the costs as percentage of the gross national budget (GNB) for a better comparison.

Political and Social Impacts

Social Psychological Impact →

This category focuses on behavioural reactions in the population caused by fear, anguish and/or anger. Fear and anger are driven by mistrust, a sense of powerlessness and ignorance. This can cause behaviour that is characterized by passiveness and avoidance, and/or aggression and a will to fight. Behaviour that expresses anger concerns, for example, protests, demonstrations, disturbance of public order, vandalism, aggressive broadcasting via the media (partly fed by media coverage) and / or feelings of alienation.

Fear and anger combined with distress and disgust can lead to panic and mass hysteria. Examples of events that may cause such behaviour are terrorist attacks, major transport accidents, political assassinations, epidemics/pandemics, etc.

The applicability of the following drivers should be evaluated:

- General unfamiliarity with the cause of the accident
- Uncertainty about how the accident will develop and/or how long it will last
- Uncertainty about who will be directly affected by the accident
- Lack of possibility for the population , through deliberate actions, to avoid the consequences of accidents
- The accident is caused by malicious acts
- Vulnerable groups are affected disproportionally
- National authorities or private companies are perceived by the population as being responsible and are portioned with the blame for the accident or for its consequences
- National authorities cannot satisfy the population’s demand for reliable information about the accident, its development or the way it is being handled
- National authorities lack the necessary means to handle the accident in accordance with the population’s expectations

The scoring is calculated based on the following variables:

- applicability of drivers
- average level of applicability of the drivers

Letters A to E are assigned numerical values 1 to 5. The total score for this criteria is based on the average scores of the individual drivers.

Political and Social Impacts

Social Psychological Impact →

Level of applicability Drivers	Low	Low to average	Average	Average to high	High
Unfamiliarity with accident	A	B	C	D	E
Uncertainty about development	A	B	C	D	E
Uncertainty about affected	A	B	C	D	E
Unable to avoid consequences	A	B	C	D	E
Malicious Attacks	A	B	C	D	E
Vulnerable groups affected	A	B	C	D	E
Authorities are to blame (or not trusted)	A	B	C	D	E
Lack of reliable information	A	B	C	D	E
Lack of means to handle accident	A	B	C	D	E

Disruptions to Daily Life →

To experience reduced ability or opportunity to carry out daily tasks, reduced freedom of movement, gathering in public spaces or participation in normal social gathering. The disruptions are often caused by a breakdown in critical infrastructure, such as the power supply system or public transport, or they may be caused by a lack of functions vital to society, such as banking services, transport of goods, health services, etc. Examples of events that may disrupt daily life are terrorist attacks, extreme weather, pandemics, floods, etc.

The following indicators of potential disruption to daily life must be assessed

- People are unable to communicate through regular ICT systems
- People are unable to get to work and/or school
- People do not have access to important public services
- People are unable to purchase necessities

The score is calculated based on the following variables:

- number of people impacted
- duration

Number of people Duration	100-10 000	10 000-100 000	100 000-1 mil.	> 1 mil.
< 1 week	A	B	C	D
1 week to 1 month	B	C	D	E
> 1 month	C	D	E	E

The highest score is then used.

APPENDIX B

Calculating Consequence and Likelihood Score

Category	Consequences
A	Low
B	Medium
C	High
D	Very high
E	Catastrophic

When each of the eight consequence criteria have been assigned a score (A-E), they aggregate into a total score for the scenario. The total score will also be placed in the A-E categories. Below follows an account of how this calculation is carried out:

The consequence criteria are assigned a score from A to E. Each score has an underlying quantitative value. This value increases exponentially between the categories, with the baseline established at 2. In principle, this means that a B is two times as serious as an A, a C two times as serious as a B, etc.

Category	Absolute
-	0
A	1
B	2
C	4
D	8
E	16

The various criteria have an equal weight. The total consequence score for a scenario is achieved by multiplying the value of each criterion's quantitative value, and then totalling the values. Here is an example of the operation:

Criterion	Category	Absolute
1.1	D	8
1.2	B	2
1.3	-	0
2.1	C	4
2.2	B	2
2.3	A	1
3.1	C	4
3.2	B	2
Total	C	23

When assessing likelihood the assignment is based on expert assessments. The estimates reflect the likelihood of such an event to occur in the Baltic Sea region within the coming five-ten years. The table below shows the relation between the likelihood assessments and the assigned score.

Category	Qualitative description	Estimate (frequency)	Numerical (assigned) value
A	Very low likelihood	Less than 1 event per 1000 y	0-1
B	Low likelihood	> once per 1 000 years	1-2
C	Medium likelihood	> once per 100 years	2-3
D	High likelihood	> once per 10 years	3-4
E	Very high likelihood	> once per 1 year	4-5

If data is available, more detailed assessments of likelihood can be made, e.g. once per 200 years, or once per 50 years.

Notes

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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.

The project was supported by the EU Civil Protection Financial Instrument. Project Lead partner and Coordinating Beneficiary – Council of the Baltic Sea States (CBSS) Secretariat

Project partners
Frederikssund-Halsnæs Fire & Rescue Service
Estonian Rescue Board
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

St. Petersburg University of State Fire Service of EMERCOM of Russia (under external funding agreement secured by the Swedish Institute)

EUSBSR Flagship Project 14.3 – Nanna Magnadóttir – Gertrude Opira (14.3 Task A Project Management CBSS Secretariat)

Fourteen Point Three Notebooks Edited by
Egle Obcarskaite – Anthony Jay Olsson (14.3 Task B CBSS Secretariat)

Visual
Fourteen Point Three Notebooks Design by Laura Klimaite (www.laurakimaite.com)
EUSBSR Flagship Project 14.3 Visual Identity by Jacek Smolicki

Special thanks to Dr. Christer Pursiainen who is now with the EC Joint Research Centre, ERNCIP, Italy

Co-financed by the EU-Civil Protection Financial Instrument

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