Disasters and Emergencies Switzerland

Risk Report 2012

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This report was elaborated by the Swiss Federal Office for Civil Protection (FOCP) in cooperation with Ernst Basler + Partner AG (EBP). The following individuals participated in the project team:

Federal Office for Civil Protection

Markus Hohl
Stefan Brem
Jürg Balmer

Ernst Basler + Partner AG

Tillmann Schulze
Niels Holthausen
Esther Vermeulen
Hans Bohnenblust
Christoph Zulauf

Publisher
Federal Office for Civil Protection
Monbijoustrasse 51a
3003 Bern

Kontakt
E-Mail: risk-ch@babs.admin.ch

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Preface

Due to the increasingly networked nature of modern societies, the growing dependence on critical infrastructures, the high concentration of value, and population growth, the damage that disasters and emergencies cause is increasing. It is therefore becoming more and more important to get prepared for coping with such events. In order to be able to react adequately to disasters and emergencies, and to return to a normal situation as rapidly as possible after an event, we must strive to understand their effects on the population and its livelihood as good as we can.

Hazard and risk analyses are suitable means to this end. They serve as an important basis for preparedness planning in civil protection at all levels of the public administration. They are useful in providing a better understanding of potential hazards, in coordinating preventive and precautionary measures, in setting priorities and in identifying shortcomings concerning response. The analyses create a shared understanding of the various effects and sequences as well as the dynamics of events. This is crucial for preparing response measures, since response activities always require close cooperation between various government agencies and third parties (NGOs, science, private sector etc.).

For the Federal Office for Civil Protection (FOCP), hazard and risk analyses are nothing new. The FOCP has already carried out a number of studies on disaster and emergency risks since the 1990s (KATANOS 1995, KATARISK 2003). The present Risk Report 2012 marks the beginning of a continuous process of analysis on the part of the FOCP. Until 2015, further events will be analyzed and integrated into the overall analysis, thus continuously the Swiss risk landscape.

In analyzing the effects of disasters and emergencies, as well as in determining their risk potential, the civil protection authorities are dependent on experts in the various hazard areas. They have the necessary knowledge and experience about the effects, occurrence, and sequence of events, which enables them to lay the groundwork for risk assessment. In the past year, more than 70 experts supported the FOCP with their expertise. Without their assistance and engagement, it would not have been possible to provide the present analysis. Therefore, I would particularly like to express my heartfelt and sincere thanks to everyone who contributed to this project. I am convinced that you have contributed in a very important way to the security of Switzerland and the protection of its population.

Willi Scholl
Director, FOCP

Summary

Organizations dealing with response to disasters and emergencies face a broad and diverse range of events – naturally, technically, and societally induced disasters and emergencies – whose effects may damage the population or its livelihood. The response to such hazards must therefore be organized and planned in advance. In order to acquire a systematic overview of the hazard potential of possible disasters and emergencies, the responsible organizations in the field of disaster management make use of the analysis of hazards or risks, respectively. This involves identifying the spectrum of possible hazards, developing specific scenarios, analyzing their effects in a differentiated manner, and assessing the likelihood of occurrence for the scenarios described. This analysis is a crucial basis for preparedness planning in disaster management at all levels of government.

Based on Art. 8 (Research and Development) of the Federal Law on Protection of the Population and Civil Protection (BZG, SR 520.1) and the quadrennial mandats 2008-2011 / 2012-2015, the FOCP has conducted a nationwide hazard analysis with the following aims:

- Develop a method for analyzing the risk of disaster and emergency scenarios
- Elaborate standardized scenarios and other uniformly structured foundations for disaster management
- Establish efficient and continuous analytical processes for disasters and emergencies.

The method is documented in a detailed Report. The results are documented in the present Risk Report 2012.

The analysis carried out for the Risk Report 2012 is based on a methodology that builds on earlier work in civil protection as well as on efforts in other countries. Risk is defined as the measure of the hazard potential of an adverse event. It is composed of several factors: the likelihood or frequency of occurrence (or, in the case of maliciously caused events, plausibility), respectively, and the negative effects on the population and its livelihood. The risk of a hazard is based on scenarios. In order to analyze the extent of the damage, twelve damage indicators were derived from the Swiss Federal Constitution that describe the consequences for individuals, the environment, the economy, and society at large (subjects of protection).

In an initial step, twelve hazards were analyzed in detail. The hazards chosen were to be as representative as possible, with up-to-date research findings and evidence, in order to be able to validate the method developed based on the greatest possible diversity of hazards and impacts. This selection is not exclusive and will be complemented by further hazards in the coming years. For every hazard, information was systematically assembled in a so called “hazard files” listing important aspects on the threat in a compact and concise manner. The scenario is the centerpiece of the file and serves as the basis for the hazard analysis.

In the hazard files, the knowledge and experiences of various expert agencies is consolidated to improve the work of crisis and joint staffs. They serve as planning assumptions for preparedness measures in disaster and emergency response such as emergency plans, resource planning, and operational concepts. They may also be used for civil protection training or in planning combined exercises for disaster response. The main audiences are the Federal NBCN Crisis Management Board, the partner organizations of the civil protection system at all levels, and the Security Network Switzerland (Sicherheitsverbund Schweiz, SVS).

In order to be able to assess the risk of individual scenarios, hazard-specific expert workshops were conducted. Each of these was attended by five to ten experts. Overall, 65 experts from the Federal Administration, the cantons and municipalities, academia, and the corporate sector participated in the analysis process. Furthermore, in a half-day workshop, representatives of the (re-) insurance sector validated the scenarios listed in the hazard files and the impact profiles resulting from the analysis.

The results attained by analyzing the extent of damage and frequency or plausibility for each of the twelve scenarios investigated can be visualized in a risk diagram. It illustrates the risk potentials of the

scenarios investigated as they relate to each other. Together with the hazard files, the risk diagram constitutes a well-founded, transparent, and reproducible decision making basis in the framework of Switzerland's disaster management.

Cooperation in the development of hazard scenarios and risk assessment with the response and prevention experts in reviews and workshops has proven very fruitful. It is an efficient way to integrate large amounts of information, know-how, and experience into the analysis.

These workshops resulted in structured compilations of information on the effects and extent of damage, which constitute a unique assembly of expertise on the hazards investigated and facilitate focused analyses for specific damage indicators. For instance, in order to give guidance for the further development of civil protection, it is possible to compare the damage indicator "individuals in need of assistance" as a way of gauging the response effort required for a given hazard. The risk dialog carried out in the framework of the national analysis also promotes timely and interdisciplinary debate on hazards. This dialog and the collaboration between representatives of the corporate sector, academia, and public agencies further increase competence levels in dealing with hazards and improve networking between these actors.

The analytical process itself, its results and products (hazard catalog, hazard files, method and risk reports) constitute a well-founded point of departure for a systematic approach to national disaster management. Furthermore, these results and products also support the implementation of the National Strategy on Critical Infrastructure Protection and are available to interested parties.

The various steps of this workflow are designed to be translated into a continuous projectable work process. Another 21 hazards will be analyzed and integrated into the analysis by 2015. In this way, the risk-based overview of disasters and hazards in Switzerland will be progressively expanded and developed.

The workshops to assess these hazards by 2015 allow to further expand the network of actors in the public administration, academia, and the corporate sector and to intensify the exchange of knowledge. An annual information event will be held to foster risk dialog and exchange lessons learned as well as to inform the partners of the network about new products and update insights of the analysis.

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1 Introduction

1.1 Background and mandate

In preparing for adverse events, organizations dealing with disaster and emergency response cannot restrict themselves exclusively to one hazard or one group of hazards, such as natural disasters. They are confronted with a broad spectrum of events, such as naturally, technically, or societally induced disasters and emergencies whose effects may harm the population and it livelihood. Usually, many actors at various organizational levels and from various areas of responsibility (public administration, academia, corporate sector, etc.) are involved in responding to disasters and emergencies. Therefore, the response to such hazards must be organized and planned in advance.

In order to gain a differentiated overview of the hazard potential of possible disasters and emergencies, the organizations responsible for disaster management make use of the analyses of hazards or risk analyses, respectively. As in the case of risk management (e.g., in accordance with ISO 31000), the spectrum of potential hazards is identified, specific scenarios are developed, their effects are analyzed in a differentiated manner, and the likelihood of occurrence is assessed for the scenarios described. The analysis facilitates a comparison of the hazard potential of various disasters and emergencies and constitutes a core foundation for preparedness planning in disaster management. The analysis reveals shortcomings in response capacity and allows responders to develop preparedness measures and coordinate these with preventive activities.

The Federal Office for Civil Protection FOCP supports the authorities involved in disaster and emergency preparedness and response, in particular the competent branches of the Federal Administration, the cantons, and the partner organizations of the integrated civil protection system. At the federal level, one of the FOCP's responsibilities is risk-based planning of protection, rescue, and assistance measures, and it deals with response to hazards affecting the population and its livelihood as well as cultural goods.

In the area of hazard and risk analysis as well as disaster and emergency response, the FOCP – in cooperation with the cantons is in charge of research and development (BZG, SR 520.1).

National-level risk analyses from the perspective of civil protection have already been conducted at earlier stages in the framework of the KATANOS[1] and KATARISK[2] projects. Both of these research project concentrated on a selection of specific hazard types. The two studies formed a centerpiece for risk-based planning in Switzerland's disaster management, for instance in the cantonal hazard analyses that were conducted with the KATAPLAN method.[3]

The demand for updated basic information in the area of disaster management has constantly increased since the publication of KATARISK and the implementation of risk analyses at the cantonal level. Therefore, based on the quadrennial mandate 2008-2011, a new project for the elaboration of a national hazard analysis was launched in 2008. The new hazard analysis was intended to expand upon the existing work while simultaneously facilitating an expansion of both the hazard spectrum and the scope of hazard impact. The analysis was to take into account events and developments together with their effects on the environment, the economy, and society at large as well as the consequences for individuals. In accordance with FOCP's quadrennial mandate 2012-2015, adequate methodologies, products, and work processes were to be developed in order to transform the entire analysis into a permanent process.

The present Risk Report 2012 illustrates the procedure for elaborating a national risk analysis for disas-

[1] FOCD (1995) KATANOS. Katastrophen und Notlagen in der Schweiz. Eine vergleichende Übersicht. Federal Office for Civil Defense (FOCD), Berne.
[2] FOCP (2003) KATARISK. Katastrophen und Notlagen in der Schweiz. Eine Risikobeurteilung aus der Sicht des Bevölkerungsschutzes. Federal Office for Civil Protection (FOCP), Berne.
[3] FOCP (2008) Leitfaden KATAPLAN – Kantonale Gefährdungsanalyse und Notfallvorsorge, Federal Office for Civil Protection (FOCP), Berne.

ters and emergencies in Switzerland. Since the analysis is to be perpetuated as an ongoing process, its method and approach were tested in practice against selected hazards. The initial phase concentrated on a selection of hazards that are primarily managed by security policy instruments (civil protection, armed forces, intelligence services, etc.), either separately or jointly. The Risk Report 2012 therefore does not present a final analysis of all relevant events in the field of civil protection, but shows how the goal of a continuous analytical process for disasters and emergencies can be achieved in a joint and collaborative approach.

1.2 Goals and audience

1.2.1 Goals and purpose

The overarching goal of these efforts is to develop risk-based planning assumptions for organizations involved in the management of disasters and emergencies. The focus is on creating a transparent, comparative overview that can serve as a foundation for prioritization and preparedness planning.

This analysis lays the groundwork for better coordination of planning and development efforts in the field of disaster management in Switzerland. The developed products promote preparations for a more systematic approach in disaster management and foster a more comprehensive risk culture.

For the Risk Report 2012 the following goals were paramount::

- To develop a method for analyzing the risk of disaster and emergency scenarios that would facilitate the integration of a broad spectrum of hazards and allow a comparison between various hazard scenarios.
- To develop, in collaboration with experts and based on existing expertise and researche findings, consistently structured scenarios for disasters and emergencies and determine the risks they hold for Switzerland.
- To structure the approach and method in such a manner as to allow the continuous coordination, updating, and further development of an efficient process of analysis for disasters and emergencies by the FOCP.

1.2.2 Audience

The analysis and products thus developed are aimed at organizations tasked with disaster and emergency management and with planning and preparations for emergency operations. In this preparatory work, crisis management organizations and first responders are usually in touch with various actors from various areas of responsibility and with different areas of expertise. In the case of a disaster or emergency, there is an need for trans-jurisdictional strategic and operational cooperation at the various administrative levels. In order to facilitate joint preparations, consistently structured planning assumptions that rest on a systematic analysis is crucial. Therefore, cantonal command staffs and the Federal NBCN Crisis Management Board as well as the Critical Infrastructure Protection (CIP) Program or the Security Network Switzerland (Sicherheitsverbund Schweiz, SVS) are among the core audiences of this Risk Report and the products associated with it.

1.2.3 Structure of the Risk Report 2012

In the following sections, the methodological foundations of this risk analysis will be summarized (Chapter 2.1) together with an explanation of how this method was applied in practice in the context of the Risk Report 2012 (Chapter 2.2). Subsequently, the results and products developed in the context of the analysis are presented, and their application in the context of disaster management is explained (Chapter 3). The focus here is on the hazard files developed together with the respective scenarios, as well as the risk diagram that displays the aggregated damage, frequency, or plausibility, respectively, of all scenarios analyzed. Chapters 4 and 5 list the insights resulting from the first phase of analysis and show how the initial phase and the application of the method can be used to create a continuous working process for risk analysis.


SCHWARZWALD
BAAR-KREIS

2 Methodology and risk analysis process

2.1 Methodological foundations

The hazard and risk analysis projects KATANOS and KATARISK assessed a range of hazards with respect to their impact based on damage indicators and likelihood of occurrence. The analysis performed for the Risk Report 2012 is based on a methodology that was further developed on the basis of these earlier analyses. However, it also takes into account the approaches taken in other countries.[4]

Compared to earlier efforts, the new method facilitates the analysis of a broader spectrum of hazards and allows these to be placed in a more comprehensive context.

Due to the broader range of hazards investigated, more damage categories and indicators are used in order to be able to assess the nature of the damage in question. For instance, more detailed impact profiles were generated than in earlier studies, i.e., there is a more detailed analysis of the nature and extent of damage to individuals, to the environment, to the economy, and to society.

The method and approach were conceived in such a way that allows scenarios for certain hazards and their effects to be developed and analyzed together with experts. In this way, the knowledge and experience of the experts in question is integrated into the analysis. In the following, a summary of the method is provided and the approach used in the analysis is described.[5]

2.1.1 Scenarios

The development of scenarios is frequently used in disaster management for preparing against events. In this context, scenarios are not regarded as prognoses. Rather, as working hypotheses, they project potential courses of action that might determine the shape of disasters and emergencies. They are thus preparatory in a manner comparable to that of exercises. The exemplary description of a hazard within a scenario anticipates the development of such an event as well as the possible impact of the hazard. This allows to anticipate and identify the possible effects of events before they occur in reality.

The hazard scenario is the foundation of any risk analysis. The extent of damage and likelihood of occurrence can be determined for every scenario developed in order to establish the corresponding risk.

2.1.2 Risk concept

Within the current analysis, risk is defined as the measure of the hazard potential of an adverse event. It consists of the factors "likelihood of occurrence" and "negative effects on the population and its resources".

The risk of a hazard is determined using scenarios by establishing the extent of damage and the likelihood of occurrence for each scenario. The risk can be deduced from the factors "extent of damage" and "likelihood of occurrence" or "plausibility", respectively.

2.1.3 Extent of damage, likelihood of occurrence, plausibility

In order to calculate risk, two factors – the extent of damage and the likelihood of occurrence (or plausibility) – must be determined for a given scenario (cf. Chapter 2.1.2). For the analysis of the extent of the damage twelve damage indicators were defined (Table 1).

These indicators were selected based on the Swiss Federal Constitution and the subjects of protection listed in it. The damage indicators were assigned to four damage areas: Individuals, environment, economy, and society. The twelve damage indicators are

[4] Cabinet Office UK (2012) National Risk Register for Civil Emergencies. 3rd edition.
Department of Homeland Security (2011) Strategic National Risk Assessment: The Strategic National Risk Assessment in Support of PPD 8: A Comprehensive Risk-Based Approach toward a Secure and Resilient Nation.
BBK (2010) Methode für die Risikoanalyse im Bevölkerungsschutz. Wissenschaftsforum, Band 8. Bundesamt für Bevölkerungsschutz und Katastrophenhilfe.
Ministry of the Interior and Kingdom Relations (2009) Working with Scenarios, Risk, Assessment and Capabilities in the National Safety and Security Strategy of the Netherlands.

[5] This methodology is described in detail in: FOCP (2012c). A Method for Risk Analysis of Disasters and Emergencies in Switzerland.

described in detail in the study "A Method for Risk Analysis of Disasters and Emergencies in Switzerland" (FOCP 2012c), which was developed as part of this project. Originally, a damage indicator "Curtailment of Basic Rights" had also been envisaged. During the initial phase, however, it has become clear that the description in the Swiss Federal Constitution leaves room for interpretation, which has given rise to varying assessments concerning effects. Therefore, the damage indicator was no longer taken into account in the analysis. Should the indicator be applied in future analyses, it would need to be defined more precisely in order to avoid discrepancies in interpretation.

Table 1: Overview of damage indicators used in the national hazard analysis on disasters and emergencies as well as corresponding articles in the Swiss Federal Constitution.

Damage area	Indicator	Reference in Constitution
Individuals	Fatalities	Art 10, 57, 58, 61, 118
	Casualties/sick people	Art 10, 57, 58, 61, 118
	Individuals in need of assistance	Art 12, 115
Environment	Damaged ecosystems	Art. 74,. 76, 77, 78, 104
Economy	Asset losses and cost of coping	Art. 61
	Reduction of economic performance	Art. 100
Society	Supply shortfalls and disruptions	Art. 102
	Diminished public order and domestic security	Art. 52, 185
	Reputational damage	Art. 54
	Loss of confidence in state/institutions	Preambel, Art. 2, 5
	Reduction of territorial integrity	Art. 58
	Damage to and loss of cultural goods	Art. 2, 69, 78

In order to integrate the various types of effects (damage indicators) for the purpose of assessing the risks and displaying them in a risk diagram, the values for the individual damage indicators must be aggregated. The aggregated extent of damage is calculated by converting each damage into the same unit – in this case, monetary value. For the purposes of monetization, the marginal costs are determined for each indicator. The marginal costs are equivalent to the approximate amount of money that society is willing to pay in order to reduce the extent of damage of an indicator by one unit (KATARISK 2003). This willingness to pay may be the result of an environmental economic assessment or a normative determination, for example. The monetized damage can be added up for an aggregated value. The aggregated value represents the extent of damage across all indicators.

To facilitate aggregation of non-quantitatively defined indicators, each class for damage extent was assigned the mean value determined for the same class for extent under the indicator "Asset losses and coping costs".

For the scenarios developed, the likelihood or frequency of occurrence was determined as a second factor, to the extent possible (Table 2).

Table 2: Classes of frequency and likelihood of occurrence.

L-class	Written description	Probability	Once in ... years	Frequency (1/year)
L 8	On average, few events over a human lifespan in Switzerland.	> 30 %	< 30	$> 3*10^{-2}$
L 7	On average, one event over a human lifespan in Switzerland.	10 - 30 %	30 - 100	$3*10^{-2}$ - 10^{-2}
L 6	Has occurred in Switzerland before, but possibly already several generations in the past.	3 - 10 %	100 - 300	10^{-2} - $3*10^{-3}$
L 5	May not have occurred in Switzerland yet, but is known to have happened in other countries.	1 - 3 %	300 - 1000	$3*10^{-3}$ - 10^{-3}
L 4	Several known events worldwide.	0.3 - 1 %	1000 - 3000	10^{-3} - $3*10^{-4}$
L 3	Only few known events worldwide.	0.1 - 0.3 %	3000 – 10 000	$3*10^{-4}$ - 10^{-4}
L 2	Only single known events worldwide, but also conceivable in Switzerland.	0.03 - 0.1 %	10 000 – 30 000	10^{-4} - $3*10^{-5}$
L 1	Only single, if any, known events worldwide. Such an occurrence is regarded as very rare even on a global scale, but cannot be fully excluded for Switzerland either.	< 0.03%	> 30000	$< 3*10^{-5}$

Maliciously induced events, e.g., in connection with political events, terrorism, or armed conflicts, cannot always be assigned unequivocal values for frequency or probability due to the rapidly changing threat environment. Also, for some of these kinds of events, very little previous experience is available. For such events, the "plausibility" of occurrence over the next decades was estimated (Table 3). The metric for assessing plausibility was patterned on the metric for assessing frequency.

Table 3: Classes for plausibility. These classes describe how plausible the occurrence of a given event in Switzerland is seen to be in the next ten years.

P- class	Plausibility of occurrence in the next ten years
P 8	Relatively plausible
P 7	Rather implausible
P 6	Implausible
P 5	Very implausible
P 4	Most implausible
P 3	Extremely implausible
P 2	Just imaginable
P 1	Hardly imaginable

2.2 Working process

The analytical procedure used in applying the method is displayed schematically in Figure 2.

2.2.1 Selected hazards for the analysis

In an initial step, twelve hazards were identified and analyzed in detail (Fig. 1). The selection of hazards and the further analyses were based on the "Catalog of Possible Hazards: Basis for Hazard Analyses" (FOCP, 2012a), which was elaborated by the FOCP in parallel to the 2012 national hazard analysis. This catalog contains a broad overview of potential natural, technical, and societal hazards that are of relevance to civil protection and disaster management.

In order to test the method and the approach in practice, the first round of analysis particular includes natural, technical, and societal hazards alike and to ensure that the levels of information available for the hazards were of varying scope and quality (e.g., earthquake vs. radiological attack using "dirty bomb"). At the same time, hazards were selected that were especially relevant to civil protection based on their effects.

Figure 1: Hazards selected from the natural, technical, and societal fields for investigation by expert workshops in 2012.

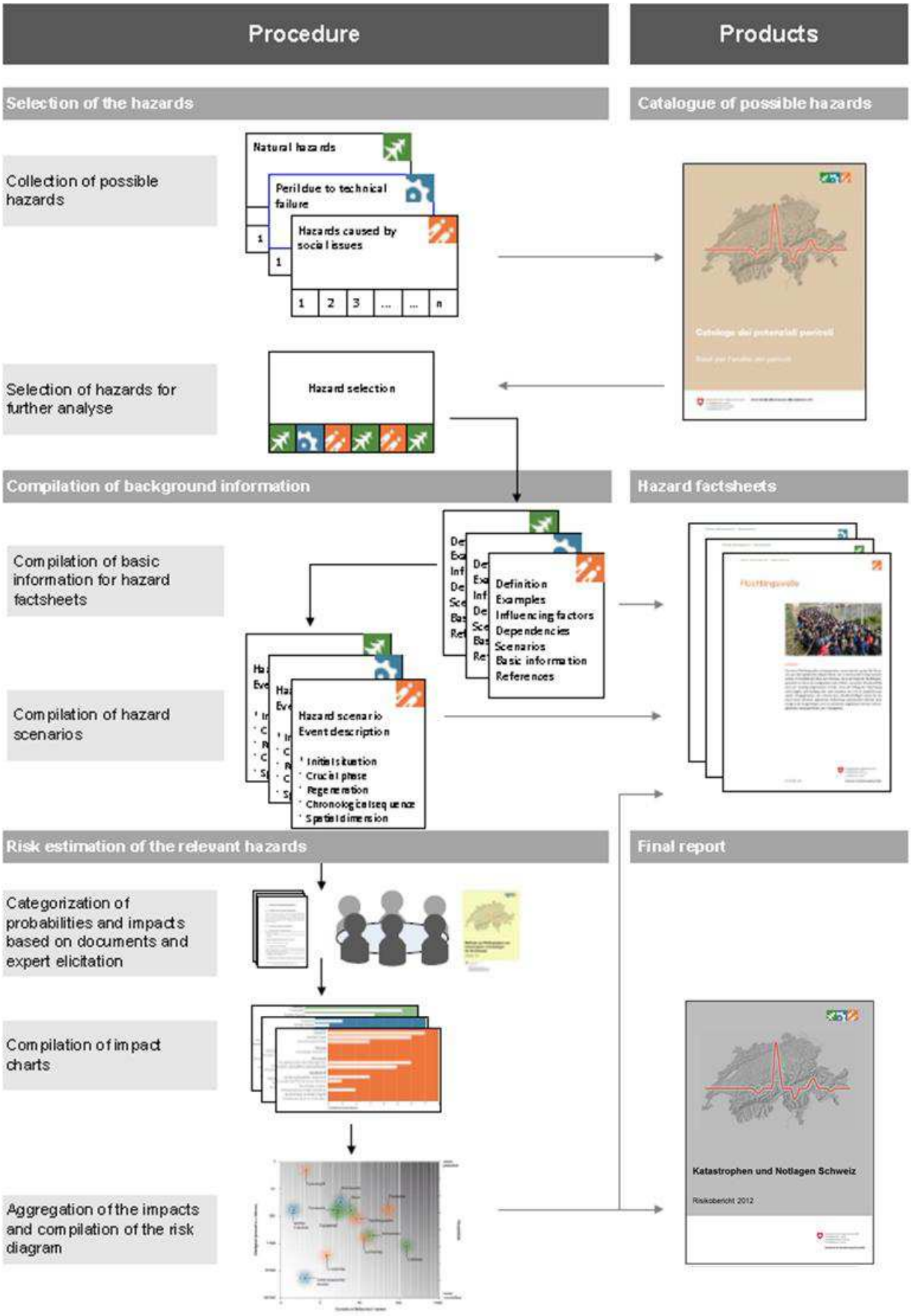

Figure 2: Schematic sequence of working steps of the national hazard analysis and the resulting products.

2.2.2 Scenarios for the analysis

Available information for the twelve hazards was processed and compiled in systematically structured scenarios. These scenarios provide an overview of how an event might progresses. The following aspects were consistently described and analyzed for all scenarios:

- Initial position/starting phase
- Event phase
- Recovery phase
- Timeline and spatial extent of the event
- Impact on the four areas of individuals, environment, economy, and society

To the extent possible, the scenarios are based on known events, but they also take possible future developments into account. The focus of descriptions is on the expected effects that are immediately attributable to the event.

For each of the twelve hazards, an escalating series of three scenarios of significant, major, and extreme intensity was briefly described as a way of illustrating the potential variation in the sequences of events (cf. the example of drought given in Table 4). In the completed analysis, out of the three levels of intensity, the respective scenarios of major intensity were described in detail and used as the basis for determining the twelve damage indicators and their frequency or plausibility. This ensured that the analysis compared scenarios of similar intensity levels. The scenarios are documented in the hazard files attached in Appendix 4 of the German and French version of the risk report.

Table 4: Exemplary description of benchmark parameters for three scenarios of varying intensity using the example of drought.

Intensity	Benchmark parameters
1 - significant	▪ No preceding drought period ▪ Locally restricted drought over three months in summer ▪ No significant heat ▪ Aridity of soil negligible shortly after end of drought period ▪ Individual small streams dry up ▪ No significant reduction of spring yields ▪ No significant effect on groundwater ▪ No long-term effects
2 - major	▪ Preceding drought period ▪ Nationwide drought in Switzerland over six months ▪ Several short heatwaves ▪ Aridity of soil negligible a few weeks after end of drought ▪ Significant reduction of spring yields detectable, including springs running dry ▪ Many streams drying up ▪ Impact on the most important groundwater detectable over a 12- to 24-month period
3 - extreme	▪ Extended preceding drought period ▪ Nationwide constant drought in Switzerland between two consecutive summers ▪ Several sustained heatwaves ▪ Aridity of soil negligible a few months after end of drought period ▪ Massive reduction of spring yields detectable, including many springs running dry ▪ Small streams running dry in many places, major rivers running dry in places ▪ Impact on the most important water tables clearly detectable over more than two years

2.2.3 Risk analysis

Hazard-specific workshops were carried out to assess the risk of the individual scenarios. In these workshops, experts assessed the extent of damage indicators and the frequency (or, where applicable, the plausibility) of a scenario. Such assessments were carried out in structured group discussions patterned on the Delphi approach. The method was tested and validated in December 2011 together with various experts in the fields of risk analysis and risk management.[6] It is documented in detail in the report "A Method for Risk Analysis of Disasters and Emergencies in Switzerland" (FOCP, 2012c).

In their efforts to assess the risks associated with the respective hazards, these experts referred to existing research and information such as studies, event analyses, exercise evaluations, statistics, literature, field reports, other scenarios, etc. Within this base of proven data, the effects for the specific scenario developed were investigated and assessed. In cases where information was lacking or where there was a great deal of uncertainty concerning the extent of effects or about the frequency or likelihood of scenarios, the experts worked on the basis of well-founded assumptions.

Five to ten experts took part in each of the workshops. Overall, 65 experts from the Federal Administration, the cantons, academia, and the corporate sector participated (cf. Appendix 2).

2.2.4 Aggregating damage values

In order to display the twelve damage indicators measured for each hazard in a diagram, the values are aggregated. To this end, the assessed damages are converted into monetary value and added up for total damage. The detailed approach for aggregating damage values is explained in the report "A Method for Risk Analysis of Disasters and Emergencies in Switzerland" (FOCP, 2012c).

2.2.5 Dealing with fuzzy data

The scenarios analyzed include both known and well-documented phenomena (e.g., storms) and hazards that are more difficult to grasp and less well-documented (e.g., radiological or chemical attacks). In the first case, empirical values and statistical data are available for calculating frequency and extent of damage. This is usually not the case with maliciously induced events, where there is greater need for an expert assessment. But even in the case of well-known phenomena, expert assessments are indispensable – for instance, in order to determine the extent of damage indicators in the specific scenario in question. Such assessments are fuzzy by nature, as are the data derived from studies and similar sources. Therefore, the scenarios are not depicted with complete precision in tables and figures.

In addition to fuzziness regarding data and assumptions, there is also fuzziness regarding modeling of risks. Comparisons always refer to the risks of an exemplary selection of scenarios. In the development of scenarios, there is a certain degree of latitude regarding how the course of events is mapped, which in turn affects the outcome and likelihood of occurrence of the scenario. By describing several scenarios for each hazard, potential distortions can be avoided through the exemplary selection of the scenarios.

[6] FOCP (2011a) Bewertung von Gefährdungen im Rahmen von "Risiken Schweiz" – Workshop report. Federal Office for Civil Protection, Bern.

3 Results and products

3.1 Hazard files

For each hazard investigated, information is systematically compiled in a so-called hazard file.[7] The file characterizes the hazard and provides compact and incisive expert assessments on the extent of damage and on the frequency or plausibility, respectively. All hazard files (including scenarios) were assembled, checked, and validated in cooperation with experts of competent bodies in the respective fields.

The hazard files constituted the basic foundation for the expert workshops. The use of the files ensured a consistent understanding of the hazard in the interdisciplinary working groups. This shared understanding is an essential requirement for jointly elaborating an assessment of the extent of damage and of frequency or plausibility.

3.1.1 Structure

A hazard file offers a systematic overview of the hazard. All hazard files apply the same structure.

- Definition
  In order to delimit and bring consistency to the understanding of a given hazard, it is briefly defined. Wherever possible, this definition is based on existing sources (e.g., definitions given in legal texts).
- Examples
  Each file describes examples of previous instances of the hazard in question. These examples cite experiences gathered and provide an idea of the impact that the events had.
- Influencing factors
  This part lists all significant factors that may have an impact on the genesis, the sequence of events, and the extent of damage. This includes information on the source of the hazard, the timing, the place and dimensions, and the course of events.
- Dependencies
  The section on dependencies analyzes the source and the possible consequences of the hazard under investigation. The classification used is based on the "List of Possible Hazards" provided in FOCP (2012a).
- Scenarios
  Three scenarios of varying intensity are shortly outlined for each hazard (cf. 2.2.2). The scenario of "major intensity" is described in more detail. The scenario describes the effects in a differentiated manner; they are also illustrated in a diagram (Fig. 3).
- Basis and references
  The file lists the most relevant legislative foundations and references for further reading.

3.1.2 Use

The hazard files are a systematic and harmonized source of information. A shared understanding of the various effects, the course of events, and the dynamics of hazards is crucial for preparing a response, since preparations are a joint effort between various federal authorities and the cantons as well as third parties. In the files, the knowledge and experiences gained by various specialized authorities are consolidated to inform the work of crisis and command staffs (e.g. the Federal NBCN Crisis Management Board). They provide the groundwork for planning preparedness measures in disaster and emergency response, e.g., emergency planning, resource planning, or operational concepts. They can also be used for civil protection training or for planning joint disaster response exercises.

In the cantonal hazard analyses of the civil protection authorities, the hazard files are already being used to develop cantonal scenarios, for instance in the can-

[7] The hazard files can be ordered individually from risk-ch@babs.admin.ch or downloaded as PDFs at www.risk-ch.ch in German and French.

tons of Solothurn, Thurgau, and Ticino. In the cantonal context, the hazard files are adapted to each canton's requirements and the scenarios amended for local conditions (e.g., geographic or demographic circumstances). The compilation of event examples and influencing factors, for instance, is useful for developing own scenarios. Information on dependencies is used to highlight cascading effects. A similar use is also conceivable at the municipal level, as seen in the example of the hazard analysis by the City of Berne.

Hazard files are used as working tools for training purposes in civil protection (e.g., training for employees of the FOCP). They constitute an easily accessible source of information for a range of hazards that are relevant for civil protection purposes. At the same time, they may be used as starting points for planning and conceptualization of joint civil protection exercises and in other training settings.

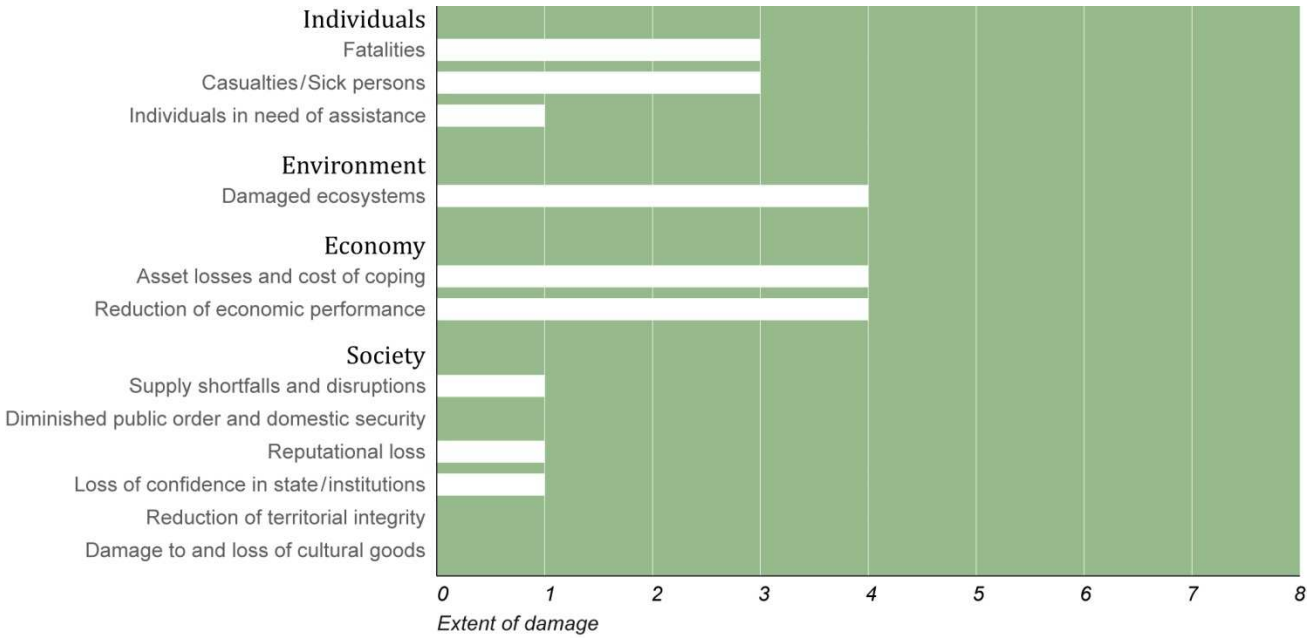

Figure 3: Example of an impact profile, in this case for a drought scenario. It displays the expected extent per damage indicator in the scenario described (which was elaborated in a workshop). Damage increases by a factor of 3 per damage extent class. Damage extent class 1 is equivalent to 1-10 deaths, class 2 is equivalent to 11-30 deaths, etc. The values corresponding to each class for extent per damage indicator are listed in Appendix 3.

3.2 Risk diagram

The results of the analysis for extent of damage and frequency or plausibility, respectively, are displayed in a risk diagram that allows scenarios to be placed in relation to each other. This diagram facilitates a comparison of the respective scenarios and their risk.

3.2.1 Description of the risk diagram

Fig. 4 displays the results of the analysis of the previous twelve workshops in a risk diagram. The two vertical axes represent frequency (left; once in x years) and plausibility (right). The horizontal axis of the diagram represents the aggregated extent of damage. The axes "Frequency" and "Damage in billions of CHF" follow a logarithmic scale, i.e., frequency and extent of damage decrease and increase, respectively, by a factor of 10 for each unit marker (see labeling of axes).

Each symbol in the diagram represents one hazard scenario. Natural hazards are depicted in green, technical hazards in blue, and societal hazards in orange. The location of the symbol represents the aggregated damage and the corresponding value for frequency or plausibility. Symbols with circles represent scenarios analyzed in terms of frequency; dotted symbols represent scenarios analyzed in terms of plausibility.

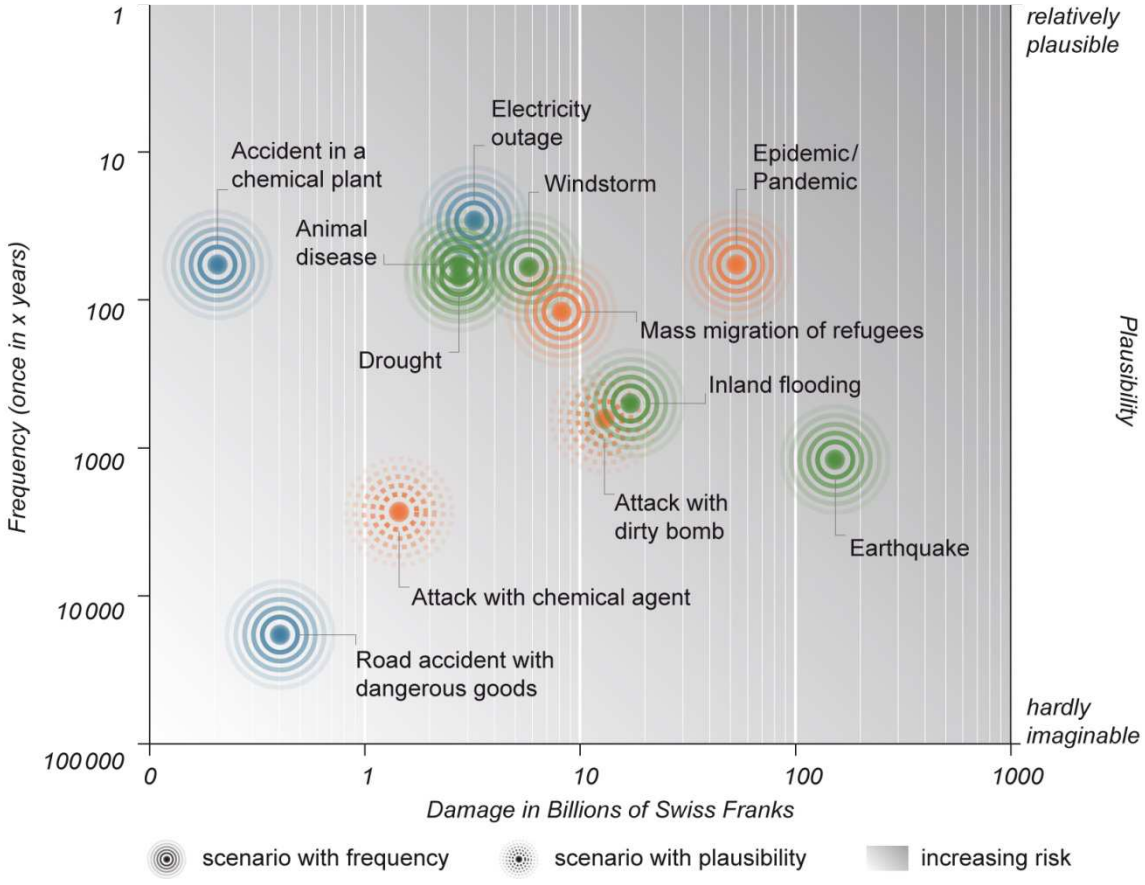

Figure 4: Risk diagram representing the risks associated with the twelve hazard scenarios studied. The closer to the top right corner a scenario is located, the higher its risk. Maliciously induced events are allocated to plausibility classes (right-hand scale, dotted symbol), others to frequency classes (left-hand scale, circle symbol). Damage consists of aggregated damage indicators and is displayed as monetary value. Natural hazards are colored green, technical hazards blue, societal hazards orange.

3.2.2 Description of the results

As one would expect, the scenarios for earthquakes and pandemics have a comparatively high damage potential, while the damage potential of an accident in a chemical plant or of a road accident with dangerous goods is comparatively limited. The scenario of a electricity outage was assessed as having the highest frequency, while the scenario of a road accident with hazardous material was estimated as having the lowest frequency.

Since the "major intensity" level was studied in the hazard scenarios for all hazards, comparisons it is legitimated to draw comparisons between the various scenarios.

The risk diagram shows that out of the twelve hazards studied, the "pandemic" scenario holds the most severe risk for Switzerland, followed by the scenarios "earthquake" and "electricity outage". The risk of the latter two was assessed as being roughly equally high. The risk of an earthquake scenario is characterized by high levels of damage. The power failure scenario is regarded as occurring with a relatively high frequency.

Of the natural hazards, the scenario "storm" is seen as having the second greatest risk after "earthquake".

The scenarios "mass migration of refugees", "animal disease", "drought", and "flooding" have similarly high risk levels, but vary in terms of damage and frequency.

The risk of a radiological attack was assessed as being higher than that of a chemical attack. The latter scenario was among the hazard scenarios with the lowest risks, together with "road accident with hazardous material" and "accident in a chemical plant".

3.2.3 Use

The risk diagram summarizes the results of twelve expert workshops on the selected hazard scenarios. The diagram shows the hazard potential of the investigated scenarios as they relate to scenarios associated with other disasters and emergencies. Together with the hazard files, the risk diagram offers a well-founded, transparent, and reproducible basis for decision making in Swiss disaster management.

The risk diagram and the impact profiles serve as a basis for prioritizing various hazard scenarios in terms of their expected damage for Switzerland and their respective frequency or plausibility. Preparedness planning and preparation for disaster and emergency measures can be based on such risk-based prioritization. Furthermore, planning resources can be allocated in a targeted and well-timed manner.

The risk diagram provides situational awareness of disasters and emergencies in Switzerland. This focus is particularly useful to support planning efforts at the federal level. Accordingly, the results are used in operational preparedness measures of the Federal NBCN Crisis Management Board. They are also applied in the context of implementing the Strategy for Civil Protection 2015+.

Planning for cantonal hazard analyses is based on the results of cantonal analyses, i.e., on their risk diagrams and scenarios. The nationwide risk diagram allows the cantons to position their own results in a national context and to validate them.

At the international level, there have been increasing calls for more comprehensive risk analyses as part of national disaster management.[8] These efforts, too, are aimed at creating risk-based foundations for preparedness planning. In the context of international cooperation and joint preparation for disasters and emergencies, the diagram is an important instrument for communicating the hazard potential of certain events from a Swiss perspective. It illustrates how risk-based foundations are developed for planning measures to strengthen national disaster management, and facilitates a systematic analysis in support of requirements and requests in international planning.

Use and interpretation of the risk diagram must always take into account the approach used in determining risks as well as the perspective that informed the analysis. The present analysis assessed the impact

[8] European Commission (2010) Risk Assessment and Mapping Guidelines for Disaster Management. Commission staff working paper SEC (2010) 1626 final.
G20 / OECD (2012) Disaster Risk Assessment and Risk Financing. A G20 / OECD Methodological framework.
ISO 22301:2012 (2012) Societal security – Business continuity management systems – Requirements.

of disasters and emergencies for *Switzerland*. To this end, an appropriate selection of damage indicators was made to depict the damage for Switzerland or for the population and its livelihood, respectively. The aggregated sum of damage for each scenario facilitates a relative comparison between the scenarios. For instance, when it comes to impact, the analysis shows that the "earthquake" scenario will have more serious impact or higher damage than the "epidemic/pandemic" scenario, if measured according to the same parameters. However, the aggregated damage sums cannot necessarily be compared to damage figures in other studies on the same hazard, since there are generally differences in the damage indicators used (e.g., focus on the damage to buildings or reputational damage) and/or the perspective taken in the analysis (e.g., insurance perspective or biodiversity perspective).


EINSATZLEITUNG
Pendenzen / Massnahmen
Mitteltabelle
Lagerapport
Schadenplatzkommando
Chemiefachberater
Einsatzleiter Chemiewehr
Einsatzleiter Sanität Basel
Dienst-Of BF Basel
SRH

4 Conclusion

4.1 Method

The method developed for risk analysis of disasters and emergencies in Switzerland has been successfully applied in practice. The metric for assessing the likelihood of occurrence or plausibility, respectively, and the extent of damage has allowed experts to integrate a broad spectrum of hazards into their analysis, thus providing comparability between various hazard scenarios that are relevant to disaster management and civil protection. The exhaustive documentation of the method has made the results reproducible for third parties as well, thus creating the necessary level of transparency.

The method is an important precondition for conducting systemic and standardized national-level risk analyses in civil protection. For instance, in parallel to the Risk Report 2012, the method was also successfully applied in the framework of the risk analysis for reference scenarios that was conducted for the cantonal NBC protection concepts. Thus, the risk analyses for the reference scenarios for NBC protection concepts are coordinated with the analyses in the national hazard analysis.

The detailed description of the metric and of the approach, in particular with regard to the damage indicators, ensures that the experts involved in the various workshops were able to proceed in a consistent manner and with a shared understanding of the damage to be assessed. The comprehensive documentation of the method ensured comparability between the hazard scenarios, despite the significant number of experts. The only damage indicator that could not be taken into account in the analysis was “Curtailment of Basic Rights”. In the course of the work, it became clear that the description in the Swiss Federal Constitution left too much room for interpretation, leading to diverging assessment in the workshops.

Minor clarifications, e.g., in the case of the term “ecosystems” used in damage indicator En2, were made during the course of the work, and the terms were adapted in the descriptions of the indicators. Future work on hazard scenarios will therefore be able to build on a more precise and improved method.

4.2 Approach

In the development of hazard scenarios and the assessment of the risks they involve, collaboration with event response and prevention experts in reviews and workshops has proven a success. This is a new approach compared to the previous project leading to the KATANOS and KATARISK reports. It is an efficient way of integrating large amounts of information, know-how, and experience into the analysis and of systematically assessing the risk of a scenario by referring to this knowledge base. Integration of various experts means that the scenarios and risk analysis enjoy broad support. This makes it easier to collaborate on further planning and preparatory activities, as a shared understanding will have been established concerning hazards, the possible course of events, and the hazard potential.

Risk analysis is based on scenarios. Therefore, the development and description of scenarios is of particular importance. So far, in a first step, the experts have reviewed the scenarios before the workshops. However, in the workshops, it transpired that participants have additional important information to contribute. Therefore, in the future, the developed scenarios will, if necessary, be discussed in a separate workshop with the experts who will later also be responsible for the analysis of the scenario.

4.3 Database

As part of the workshop, information was systematically assembled on the effects and extent of damage created by the disasters and emergencies investigated. The resulting database is a valuable compendium of expert knowledge on the hazards investigated. It facilitates the execution of further analyses that are focused on specific damage indicators that will allow additional and damage-specific comparisons between

hazards. For instance, in the interests of further developing the civil protection system, it is possible to carry out a comparison for the indicator "individuals in need of assistance" in order to determine which volume of response effort can be expected to be caused by selected hazard scenarios.

Accordingly, the information in the database will be made available to third parties upon request, or analyses will be carried out for use in other working contexts.

4.4 Risk dialog

The exchange of information and basic data on hazards and risks is crucial in preparing for adverse events. The dialog that took place in the framework of the national analysis has inspired interdisciplinary discussion on hazards. The dialog and cooperation between actors from the corporate sector, academia, and public authorities has strengthened their competence in dealing with certain hazards and has fostered networking between them. For the experts dealing with response to multiple types of events in particular, the exchange with other professionals in the context of the analysis process is of great value.

Cooperation with experts from various areas of expertise has shown that not only public authorities and emergency services have a role to play in response to disasters and emergencies. Companies in the service or industry sectors are also important partners in managing adverse events. Operators of critical infrastructure have been especially helpful for the analyses, since they play key roles in preparation and response to events. At the same time, they are bearers of knowledge and have important information and expertise on hazards. The dialog between the public sector, private companies, and academia must be continued, and cooperation must be intensified in the area of precautionary planning and preparation for disasters and emergencies.

4.5 Planning measures

In the cantons, the respective risk and hazard analyses are used to reflect the status of preparations, to derive spheres of activities in preparation for events, and if necessary, to define the appropriate preparedness measures.[9]

The present analysis, its results, and the associated products (list of potential hazards, hazard files, and risk report, including method for risk analysis) constitute a well-founded basis for a similar approach in the sphere of national disaster management. For instance, the analysis allows the Federal NBCN Crisis Management Board, which is one of the main recipient groups of these products, to examine whether a certain hazard should be introduced into its hazard portfolio and which priority should be given to a hazard in preparedness planning and in exercises. At the same time, the scenarios can be used to determine the role to be played by the Crisis Management Board in case of an event and to establish whether its material, organizational, and technical measures are sufficient, whether they would need to be adapted for dealing with the scenario, or whether additional preparatory measures are required.

[9] FOCP (2012b) Leitfaden KATAPLAN – Kantonale Gefährdungsanalyse und Notfallvorsorge.


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5 Further steps

5.1 Establishing a continuous analysis process

The results of the Risk Report 2012 show that the method and approach developed were commensurate to realizing the goal – i.e., a systematic analysis of the risks of disasters and emergencies. As part of the project and of the work that went into the Risk Report 2012, clear procedures were defined to this end that can be efficiently implemented in practice (cf. Fig. 2). Each of these working steps lead to the products that can be, and are already being, applied as the foundations for preparing for event response at various levels and by various actors.

The procedures are set up in such a way that they can now be carried over into a continuous and projectable working process. The individual steps can be managed using the resources available to the FOCP for the activities on risk foundations.[10] This process involves periodic identification of potential hazards, the development of new scenarios, risk assessments for these scenarios, and updating of the analysis and associated products. The work will continue accordingly in 2013. The risk diagram will be annually updated to include the recently analyzed hazards and documented in a short report on the risk diagram. Existing hazard files and scenarios will be reviewed periodically or as required (e.g., if new insights are generated that necessitate a reassessment of the hazard). An expanded risk report in the current form will be published quadrennial. Workshops for reviewing the risk assessments associated with existing hazard scenarios will be organized as needed by the recipient groups.

5.2 Developing further scenarios

Another 21 hazards will be integrated into the analysis by 2015. In this way, the risk-based overview of disasters and emergencies in Switzerland will be expanded progressively.

The following hazards will be analyzed and described in a hazard file in 2013:

- Severe weather phenomena
- Solar storm
- Nuclear plant incident inside/outside Switzerland
- ICT failure
- Electric power supply shortage
- Biological attack
- Conventional attack

Another 14 hazards will be investigated in 2014 and 2015.[11]

The selection is based on the significance of these hazards for the Federal NBCN Crisis Management Board and the further development of civil protection. The selection of hazards should also be useful, however, for cantonal disaster preparedness efforts and for the implementation of the National Strategy on Critical Infrastructure Protection.

As well as developing new hazard files, the existing files will be complemented. In addition to the scenarios for "major intensity", scenarios of lesser ("significant") and larger ("extreme") intensity will be described and analyzed. This will expand the spectrum of possible scenarios for a given hazard and facilitate a better understanding of the overall risk associated with the hazard in question. Starting in 2013, scenarios at these two additional intensity levels will be developed for one natural, one technical, and one societal hazard, respectively.

5.3 Strengthening the network

Within the workshops on further hazards, the network of actors in the public administration, academia, and the corporate sector will be further expanded and information exchange will be fostered. It became clear

[10] Cf. quadrennial mandate 2012-2015.

[11] The basis for the selection of hazards is: FOCP (2012a) Katalog möglicher Gefährdungen: Grundlage für Risikoanalysen [List of Possible Hazards: Basis for Hazard Analyses].

during the elaboration of the analysis that workshop participants wished to continue the risk dialog and cooperation beyond the immediate discussion of selected hazards and to take part in a debate about the overall result. In order to inform the network that has been established about new analytical products and updated results, a joint annual information event is planned that will provide an opportunity to discuss the overall result of all the assessed hazards.

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A2 Participants of the expert workshops

The following experts were involved in workshop to assess the hazard sencarios:

Marcel	Abegg	AON AG
Beat	Aebi	Bundesamt für Bevölkerungsschutz
Dörte	Aller	Gebäudeversicherung des Kanton Zürich
Hugo	Aschwanden	Bundesamt für Umwelt
Diego	Baches	Nachrichtendienst des Bundes
Ruth	Badertscher	Bundesamt für Landwirtschaft
Jürg	Balmer	Bundesamt für Bevölkerungsschutz
Max	Benz	XL Group AG
Cornel	Bernet	Forensisches Institut Zürich
Andreas	Berta	Emmi AG
Georges	Bossert	Swissgrid AG
Stefan	Brem	Bundesamt für Bevölkerungsschutz
Andreas	Bucher	Bundesamt für Bevölkerungsschutz
Heinrich	Bucher	Proviande
Rino	Büchel	Bundesamt für Bevölkerungsschutz
Martin	Buser	Bundesamt für Umwelt
Christoph	Curchod	Bundesamt für Migration
Federico	Degen	Zürich Versicherung AG
Blaise	Duvernay	Bundesamt für Umwelt
Otto	Ebener	Lonza AG
Emanuel	Egger	Bundesamt für Bevölkerungsschutz
Rudolf	Farner	Flughafen Zürich AG
Armin	Feurer	Ernst Basler + Partner AG
Markus	Flisch	Kantonales Laboratorium Bern
Ursula	Freuler	Insurance Institute of Switzerland
Jürg	Fuhrer	Agroscop Reckenholz Tänikon
Kurt	Gimmel	Lonza AG
Gogniat	Bernard	Bundesamt für Strassen
Daniela	Hadorn	Bundesamt für Veterinärwesen
Heinz	Herzig	Bundesamt für Bevölkerungsschutz
Josef	Hess	Bundesamt für Umwelt
Salome	Hofer	Coop AG
Christian	Holzner	Bundesamt für Energie
Thomas	Jäggi	Schweizerische Bauernverband
Margrethe	Keiler	Universität Bern
Jean-Pierre	Krause	Zürich Versicherung AG

Sylvia	Kruse	Eidg. Forschungsanstallt für Wald, Schnee und Landschaft
Carlo	Laeri	Bundesamt für Bevölkerungsschutz
Anton	Lauber	Bundesamt für wirtschaftliche Landesversorgung
Roberto	Loat	Bundesamt für Umwelt
Patrick	Mathys	Bundesamt für Gesundheit
Werner	Meier	Alpiq AG
Jürg	Mühlemann	Amt für Abfall, Wasser, Energie und Luft, Kt. Zürich
Nicolas	Mueller	Bundeskanzlei
Hans-Peter	Nägeli	UBS AG
Peter	Nauck	Universitätsspital Zürich
Jean-Michel	Notz	Verband Schweizerischer Elektrizitätsunternehmen
Matthias	Oplatka	Amt für Abfall, Wasser, Energie und Luft, Kt. Zürich
Hans	Probst	Bundesamt für Bevölkerungsschutz
Thomas	Ramseier	Gebäudeversicherung Bern
Domenico	Salvati	CSS AG
Ulrich	Schär	Bundesamt für Verkehr
Blanche	Schlegel	Swissi AG
Christoph	Schmutz	MeteoSchweiz
Reto	Schneider	Swiss Re AG
Stefan	Schnell	Bundesamt für Verkehr
Michel	Sennhauser	Amt für Bevölkerungsschutz und Armee, Kt. Thurgau
Xavier	Sidler	Universität Zürich
Patrick	Smit	Bundesamt für Bevölkerungsschutz
Bruno	Spicher	Allianz Suisse AG
Franziskus	Stoffel	Bundesamt für Bevölkerungsschutz
Christoph	Werner	Bundesamt für Bevölkerungsschutz
Susanne	Widmer	Amt für Militär und Bevölkerungsschutz, Kt. Solothurn
Erika	Wunderlin	Amt für Verbraucherschutz, Kt. Aargau
Christoph	Zulauf	Ernst Basler + Partner AG

A3 Scales of damage indicators

Damage area	Indicator		Unit	A1	A2	A3
Persons	P1	Deaths	Number	≤10	11 - 30	31 - 100
	P2	Casualties/sick persons	Number	≤100	101 - 300	301 - 1'000
	P3	Individuals in need of assistance	Person days	≤200'000	200'001 - 600'000	600'001 – 2 million
Environment	En1	Damaged ecosystems	km2 * years	≤150	151 - 450	>450 - 1'500
Economy	Ec1	Asset losses and cost of coping	CHF	≤50 million	51 – 150 million	>150 – 500 million
	Ec2	Reduction of economic performance	CHF	≤50 million	51 – 150 million	>150 – 500 million
Society	S1	Supply shortfalls	Person days	≤0.5 million	>0.5 – 1.5 million	>1.5 million – 5 million
	S2	Diminished public order and domestic security	Person days	≤100'000	100'001 - 300'000	300'001 – 1 million
	S3	Reputational damage	Intensity * duration	Damage to reputation lasting only a few days and related to issues of medium importance (e.g., negative coverage in foreign media)	Damage to reputation lasting up to a few weeks and related to issues of medium importance (e.g., negative coverage in foreign media)	Damage to reputation lasting up to a few weeks and related to important issues (e.g., negative coverage in foreign media)
	S4	Loss of confidence in state/institutions	Intensity * duration	Loss of confidence lasting only a few days and related to issues of medium importance (e.g., very critical coverage in Swiss media)	Loss of confidence lasting up to a few weeks and related to issues of medium importance (e.g., very critical coverage in Swiss media, occasional demonstrations)	Loss of confidence lasting up to a few weeks and related to important issues (e.g., very critical coverage in Swiss media, occasional demonstrations)
	S5	Reduction of territorial integrity	Intensity	---	---	---
	S6	Damage to and loss of cultural goods	Number * importance	Damage to or loss of cultural goods of regional significance or individual cultural goods of national significance	Damage to or loss of several cultural goods of regional significance and individual cultural goods of national significance	Damage to or loss of several cultural goods of national significance or individual goods of international significance

	A4	A5	A6	A7	A8
P1	101 - 300	301 - 1'000	1'001 – 3'000	3'001 - 10'000	>10'000
P2	1'001 - 3'000	3'001 - 10'000	10'001 - 30'000	30'001 - 100'000	>100'000
P3	>2 million – 6 million	>6 million – 20 million	>20 million – 60 million	>60 million – 200 million	>200 million
En1	>1'500 – 4'500	>4'500 - 15'000	>15'000 - 45'000	>45'000 - 150'000	>150'000
Ec1	>500 million – 1.5 billion	>1.5 billion – 5 billion	>5 billion – 15 billion	>15 billion – 50 billion	>50 billion
Ec2	>500 million – 1.5 billion	>1.5 billion – 5 billion	>5 billion – 15 billion	>15 billion – 50 billion	>50 billion
S1	>5 million – 15 million	>15 million – 50 million	>50 million – 150 million	150 million – 500 million	>500 million
S2	1 million – 3 million	3 – 10 million	10 million – 30 million	30 million – 100 million	>100 million
S3	Damage to reputation lasting several weeks and related to important issues, but with minor impact on Switzerland's standing and international cooperation	Damage to reputation lasting several weeks and related to important issues, with impact on Switzerland's standing and international cooperation (e.g., termination of agreements with Switzerland, temporary expulsion of Swiss ambassador)	Considerable damage to reputation lasting several weeks and related to important issues, with impact on Switzerland's standing and international cooperation (e.g., termination of agreements with Switzerland, expulsion of Swiss ambassador	Considerable damage to reputation lasting up to several months with visible impact on Switzerland's standing and international cooperation (e.g., political isolation, boycotts)	Lasting, severe damage to reputation, possibly leading to irreversible loss of reputation with far-reaching impact on Switzerland's standing and international cooperation (e.g., political isolation, boycotts
S4	Loss of confidence lasting from a few weeks up to several weeks and related to important issues (e.g., strikes, larger demonstrations)	Loss of confidence lasting several weeks and related to important issues (e.g., multiple strikes, occasional mass demonstrations)	General loss of confidence lasting several weeks (e.g., extended strikes in many areas, mass demonstrations all over Switzerland)	General, considerable loss of confidence lasting up to several months (e.g., general strikes)	Lasting, severe or even irreversible loss of general confidence (formation of local or regional groups for self-organization of public life, to the point of vigilante group formation)
S5	Short-term, intentional violations of territorial integrity (e.g., civilian or military operations of foreign security forces on Swiss soil)	Short-term, grave violations of territorial integrity (e.g., repeated civilian or military operations of foreign security forces on Swiss soil)	Temporary, grave violation of territorial integrity (e.g., temporary occupation of limited area of Swiss soil)	Temporary, extremely grave violation of territorial integrity (e.g., temporary occupation of considerable area within Switzerland)	Long-lasting, extremely grave violation of territorial integrity (e.g., occupation of significant part of Switzerland
S6	Damage to or loss of many cultural goods of national significance and of individual goods of international significance	Damage to or loss of several cultural goods of international significance	---	---	---