

What risks does Switzerland face?

Disasters and Emergencies in Switzerland 2015



Schweizerische Eidgenossenschaft
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Federal Office for Civil Protection FOCP

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Editorial

Safety is a high priority for Switzerland. Absolute safety, however, is an impossible goal. Although we have been spared from major disasters in recent years, an event that causes major damage, casualties, illness and deaths can strike at any time.

The recent past shows that Switzerland is generally highly adept at managing events at the local and regional levels. Yet, the increasingly networked nature of society and our huge infrastructure density mean that Switzerland has become increasingly vulnerable. For example, a major power failure constitutes an emerging and growing risk. Likewise, we need to accept that natural disasters like flooding and storms will probably become more frequent as the result of climate change. The impact and complexity of these events are also likely to increase.

So, how well-prepared are we for major incidents with complex and nationwide consequences?

To answer this question, we need hazard and risk analyses. They illustrate what can happen and help to generate a shared understanding of the course that events can take and the impact that they will have. They also reveal possible shortcomings in existing disaster management efforts, which in turn allows us to better coordinate our preparations. Effective coordination is crucial given the many different partners who are involved in managing a disaster or emergency situation. The same point is true of the present disaster risk assessment. Some 200 experts from the federal administration, the cantons and municipalities, academia as well as representatives of critical infrastructure operators participated in this analysis. I would like to take this opportunity to thank them for the commitment they have shown and for generously sharing their expertise with us. They have helped to paint a clearer picture of Switzerland's risk landscape and, in doing so, have made a major contribution to improving safety and security in our country.

The analysis of risks is a process that must be continually fine-tuned to keep pace with a changing risk landscape. The present analysis could and should be the subject of critical debate. Intensive dialogue with all of the actors concerned will help to further improve our disaster risk assessments and, thus, Switzerland's security in general.

In this spirit, I invite you to join in our risk dialogue. With your input, we can make Switzerland an even safer place.

Ueli Maurer, Federal Councillor
Head of the Federal Department of Defence,
Civil Protection and Sport (DDPS)



How safe is Switzerland?

Our subjective sense of security is largely shaped by events from the recent past. The national risk analysis «Disasters and Emergencies in Switzerland», however, goes one step by further by including hazards that the country has rarely, if ever, had to face.

On 18 October 1356 Basel found itself blanketed in ash and rubble. A violent earthquake tore through the city, razing virtually every stone structure to the ground, while wooden buildings were engulfed by the ensuing fire. The quake was so powerful that building damage was recorded in Bern, some 60 km away.

The 1356 Basel earthquake is the most devastating seismological event known north of the Alps. Yet, nearly 700 years on, the event has been largely confined to the annals of history. Even more recent disasters and emergencies like the fire at the chemical plant of «Schweizerhalle» and the subsequent Rhine pollution in 1986 are simply a distant memory.

Higher loss potential than before

Have we allowed ourselves to be lulled into a false sense of security? While Switzerland has not suffered any major disasters or emergencies in recent times, the fact remains that the country could find itself exposed to all sorts of hazards. Today, disasters on the same scale as those which occurred in the distant past would have a much more devastating effect because 21st century Switzer-

land is home to considerably more people, infrastructures and assets. If an earthquake with the same magnitude as that of 1356 were to occur today, it is estimated that the resulting damage would be in the region of CHF 80 billion. This is almost as high as the total damage caused by the Kobe earthquake (Japan) in 1995.

National risk assessment as planning foundations

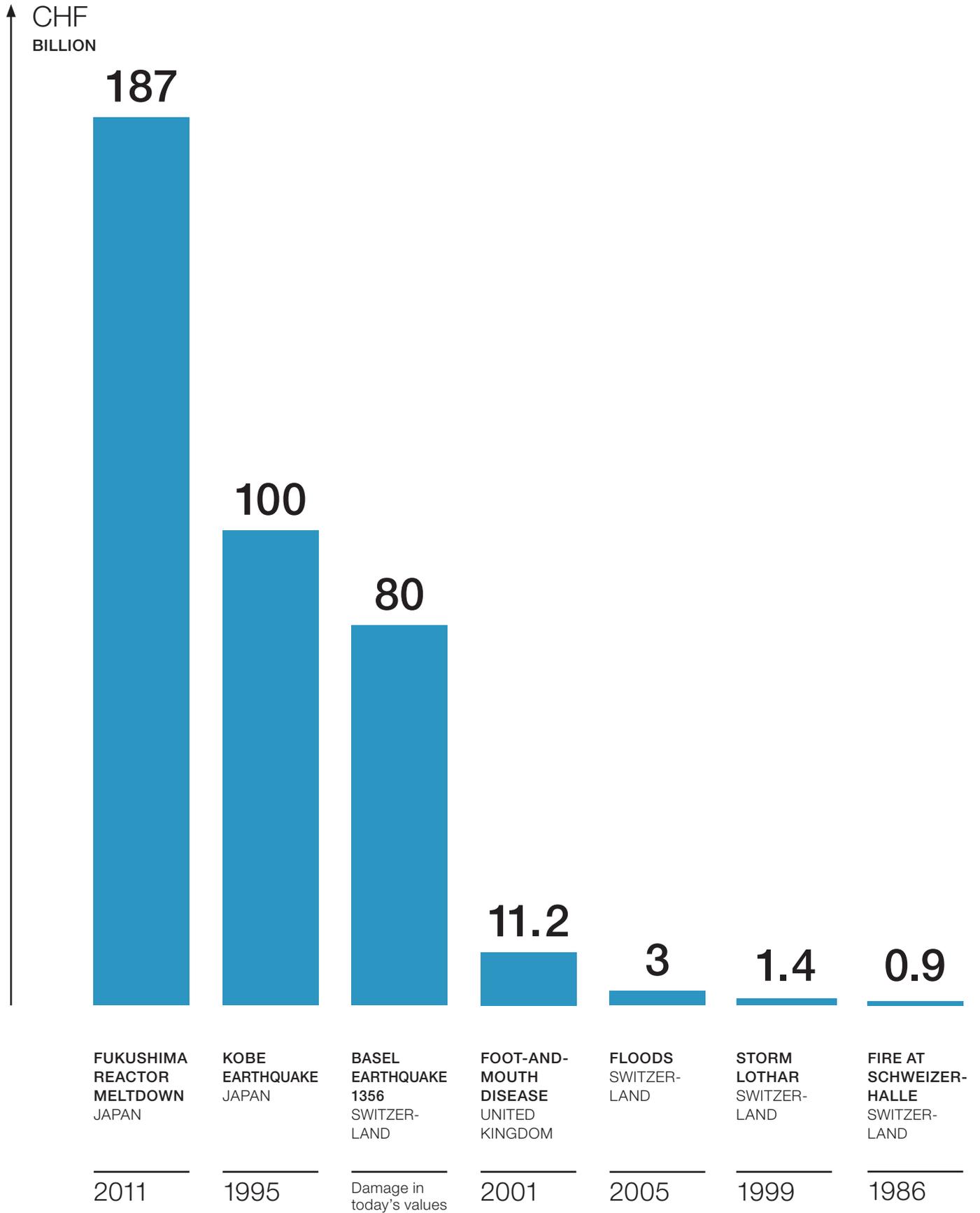
To keep the population safe and to protect their livelihoods forward-looking preparedness planning is vital. We need to know what the consequences of a given hazard could be and how often they occur. This is where the national risk analysis «Disasters and Emergencies in Switzerland» comes into play.

The assessment focuses on events and hazards of relevance to the population and disaster management agencies. Every-day risks (e. g. sport and household accidents), financial crises, espionage and organised crime were excluded from the analyses. The latter two are dealt with in the annual situation reports of the Federal Intelligence Service (FIS) and in security policy reports.

References

Fukushima: expert estimations; Kobe: Swiss Re (2000); Basel earthquake at today's values: Swiss Re (2000); Foot-and-mouth disease: Prime Minister and the Secretary of State for the Environment, Food and Rural Affairs (2008); Floods 2005: FOEN/WSL (2007); Storm «Lothar»: PLANAT; Schweizerhalle: Ivan Vince, Major Accidents to the Environment (2011).

THE COST OF DISASTERS
ESTIMATED AGGREGATED DAMAGES



Systematic preparedness planning

The national disaster risk assessment helps civil protection agencies to prepare for an effective response to all sorts of disaster and emergency situations.

What kind of disasters and emergencies could Switzerland face? What damage would they cause? How can we protect ourselves? These are the key questions for the Swiss civil protection system. The national risk analysis provides an important foundation to address these questions. «Disasters and Emergencies in Switzerland» makes it possible to transparently compare the potential risk of a wide range of hazards, such as storms, pandemics and plane crashes. By doing so, the analysis also facilitates interdisciplinary and systematic preparedness planning for an extensive range of disasters and emergencies. It finally helps to bolster Switzerland's resilience.

Consistent planning foundations

Switzerland has a large number of organisations which deal with different aspects of disaster management. These include civilian federal, cantonal and municipal command and control staffs as well as civil protection partner organisations (police, fire service, health service, protection & support service (civil defence), and technical services). With this national disaster risk assessment the Federal Office for Civil Protection (FOCP) provides a comprehensive and consistent planning foundation to all these actors.

Cantonal and municipal risk assessments

Operational responsibility for civil protection lies first and foremost with the cantons. For over 10 years, the cantons have performed their own risk assessments, with 75% of them following the KATAPLAN guidelines issued by the FOCP (see www.kataplan.ch for further information). Likewise, a sizeable number of towns and municipalities conduct risk assessments to ensure that they have well-structured and comprehensive contingency plans in place.

National risk assessments in other countries

Other countries such as Germany, the Netherlands, Sweden, the United Kingdom, Canada and Singapore carry out their own national risk assessments. While the status of this work and the methods used may differ from those of the Swiss analysis, all pursue the same goal: a comprehensive investigation and evaluation of the potential risks, disasters and emergencies that their respective countries are facing. There are two main differences between the Swiss analytical approach and those performed by other countries. First, the Swiss approach is inclusive and broad-based. No other country involves as many experts as Switzerland does. Second, the working method is completely transparent because the methodology and the findings are made public in a reproducible way.

Risk

What is the risk potential of a given hazard to Switzerland?

Risk management applies several definitions of the term «risk». The national disaster risk assessment defines it as the likelihood of a given event occurring and the extent of damage that it could cause. When taken together, these two factors – probability and extent of damage – constitute the risk that the given hazard presents. However, risk can also be defined as the hazard potential of an event.

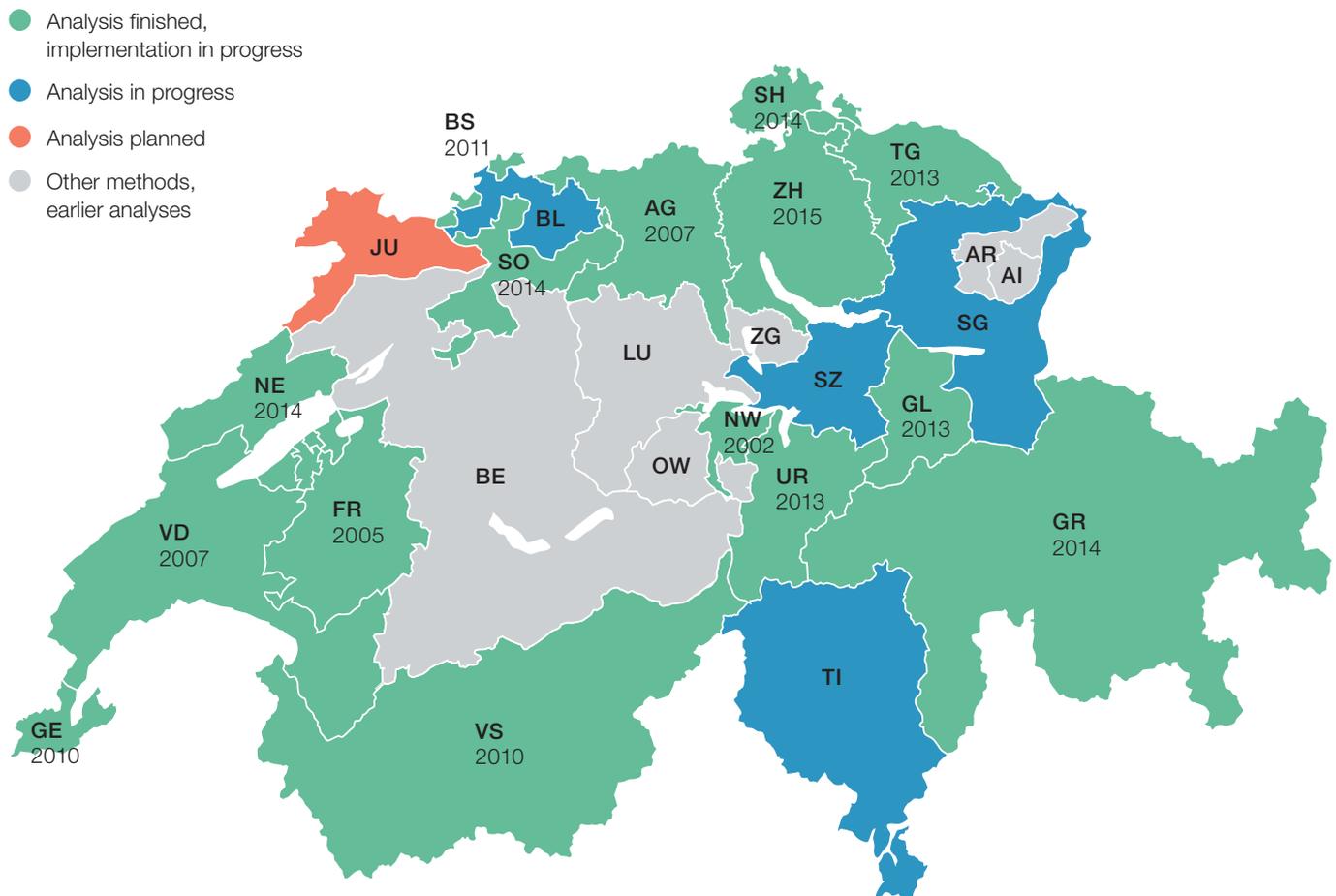
Resilience

How well could Switzerland cope with and recover from a disaster?

Particularly with technically-induced hazards, safety measures can reduce the likelihood of such a hazard materialising. For most natural hazards (e.g. extreme cold spells) this is not the case. Therefore, it is vitally important that a community like Switzerland has the capacity to cope with and recover from such a situation. One of the purposes of contingency planning is to enable a swift return to normality after a disaster or emergency situation, i.e. all key spheres of human life are fully operational again. Safety and security measures, contingency planning and flexibility to act are all part of resilience. This provides a robust foundation for an effective response to an emergency situation.

OVERVIEW OF CANTONAL HAZARD AND RISK ANALYSES

AS OF MAY 2015



33 events that could strike at any time

Natural hazards, technical failures, attacks: the type of disasters and emergencies that Switzerland could face varies widely. The national risk assessment examines 33 such events in detail.

Flooding (2005, 2007), storms (Lothar 1999) and epidemics (SARS, bird flu, Ebola) are a few of the recent events which have become engrained in our collective memory. However, the range of hazards that Switzerland could face is considerably wider and includes natural events like earthquakes and forest fires, technically-induced events like plane crashes and chemical spills, and societally-induced events like terrorist attacks and epidemics. The national risk assessment examines 33 different disasters and emergencies that could strike Switzerland. Although

the vast majority of them have – thankfully – not occurred yet on the same scale as set out in the scenarios in Switzerland, or only rarely elsewhere, they could nonetheless happen at any time. At a first glance, terrorist attacks, violent unrest or a cyber attack are not typical civil protection topics in Switzerland. However, the impact of major incidents like these require a civil protection response, hence their inclusion in the national risk analysis. More hazards will be added to the analysis over the coming years.



Natural hazards



SEVERE WEATHER PHENOMENA

Violent storms across the country, with heavy rain, lightning and hail



FLOODING

Rising water levels in streams and rivers: 300-year flooding



STORMS

Gales with winds reaching 140 km/h in many places and lasting several days



HEAVY SNOWFALL

Within a few hours, 70 - 80 cm of fresh snow falls on the Swiss Plateau



COLD SPELL

Average temperature of -10 °C during several weeks



SOLAR STORM

Partial outage of communication networks and electricity supply



DROUGHT

Nationwide drought lasting several months



MASSIVE SPREAD OF INVASIVE PLANTS

Large-scale spread of an invasive plant with the potential to cause substantial damage



FOREST FIRE

Fire across several square kilometres of forest, including protective forests



METEORITE IMPACT

Explosion of a meteorite over a residential area lasting several hours



EARTHQUAKE

Major tremors with devastating effects



HEATWAVE

Average temperatures in excess of 35 °C and several tropical nights (i.e. the temperature does not fall below 20 °C) over several weeks



Societally-induced hazards



RADIOLOGICAL ATTACK

Attack involving a radioactive substance



BIOLOGICAL ATTACK

Attack involving highly pathogenic agents



CHEMICAL ATTACK

Attack involving a chemical substance



MASS MIGRATION OF REFUGEES

Influx of several tens of thousands of refugees over a period of several months



EPIDEMIC/PANDEMIC

One-quarter of the population infected with a new and highly dangerous virus



CONVENTIONAL ATTACK

Attack involving several explosions in a heavily frequented location



ANIMAL DISEASE

An epidemic outbreak of disease in the animal population with a high mortality rate



CYBER ATTACKS

Targeted attacks on critical infrastructures as well as data theft



VIOLENT UNREST

Riots in several cities over several weeks



ELECTRICITY SHORTAGE

30% reduction in electricity supply during winter months



Technically-induced hazards



ELECTRICITY OUTAGE

Widespread regional power failure lasting several days



ROAD ACCIDENT INVOLVING HAZARDOUS MATERIALS

Spillage of huge quantities of toxic substances in a populated area



ACCIDENT IN A CHEMICAL PLANT

Large-scale spillage of extremely harmful quantities of chemical substances



ACCIDENT IN A NUCLEAR POWER PLANT

Incident in a nuclear power plant involving the unfiltered release of radioactivity



CRASH OF FLYING OBJECT

Passenger plane crashes in a populated area



RAIL ACCIDENT INVOLVING HAZARDOUS MATERIAL

Large-scale spillage of toxic substances in a populated area



INTERFERENCE WITH NAVIGATION ROUTES

Access to all Swiss Rhine ports blocked for several weeks



DAM INCIDENT

Flooding of a residential area located downstream of a dam



ACCIDENT IN A BIOLOGICAL PLANT

Release of highly pathogenic agents from a laboratory



GAS SUPPLY FAILURE

Failure of a main high-pressure line causing a temporary supply shortage



ICT FAILURE

Failures reported by several providers with repercussions for other critical sectors

What kind of damages can be expected?

The national risk assessment develops a set of standard scenarios for each of the selected hazards. The expected damage of each hazard can then be assessed and compared using these 33 scenarios together with a set of 12 damage indicators.

Specific criteria are needed to estimate the potential damage of such widely differing hazards like heatwaves, plane crashes and cyber attacks. Using 12 indicators, the national risk analysis assessed the expected damage to individuals, the environment, the economy and society should such an event occur. These indicators include for example the likely number of fatalities and people in need of assistance, asset losses, the costs of coping with the incident, and the potential loss of public confidence in the State and its institutions. This makes it possible to plot the anticipated damage of each hazard in an impact diagram.

Almost all of the indicators correspond to the constitutionally enshrined subjects of protection, i.e. people, goods, services and values requiring protection. The two exceptions are «loss of confidence in authorities» and «reputational damage» which are not explicitly mentioned in the Swiss Federal Constitution. Nonetheless, they are of relevance to disaster management – particularly in terms of the credibility of instructions that the authorities may issue to the public and how Switzerland communicates with other countries, e.g. when foreign tourists and residents are affected by a disaster.

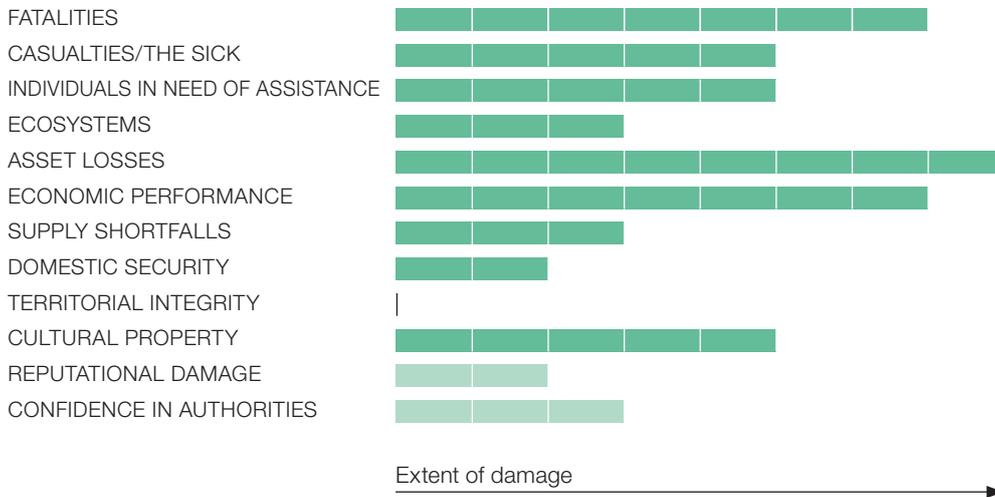
Scenario

Example for a specific course of events

Every hazard has a set of inherent features that can influence the sequence, intensity and repercussions of the event. Risk assessments rely on scenarios, i.e. descriptions of the possible sequence of events and expected consequences in relation to a given hazard. For each of the 33 hazards three scenarios with significant, major and extreme intensities have been defined. The national risk analysis is based solely on the major scenarios, i.e. relatively rare events with major intensity. Events with much more devastating consequences are also conceivable. These would constitute extreme events which would occur significantly less frequent.

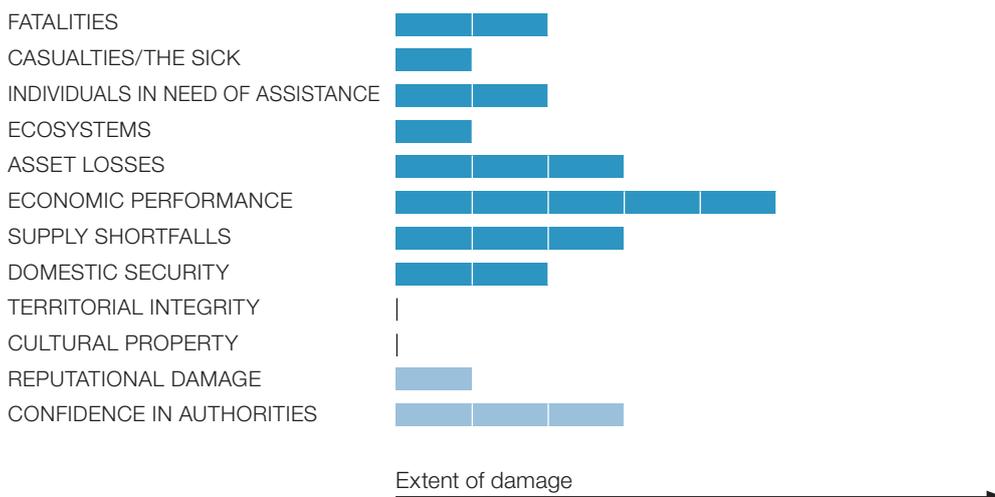
EXAMPLES OF IMPACT DIAGRAMS
BAR CHART AND BRIEF SCENARIO DESCRIPTION

Earthquake



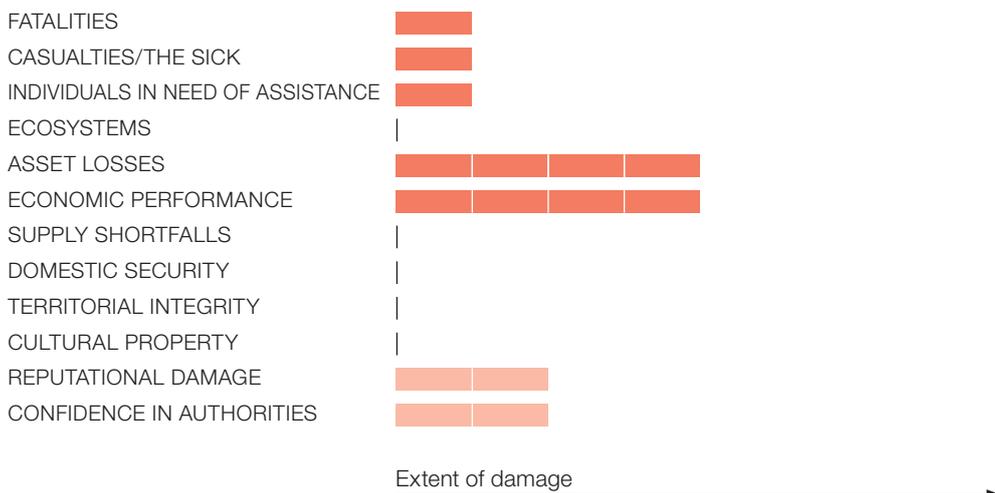
One weekday morning, a violent earthquake strikes an area with a high infrastructure density. Around the epicentre area is a scene of complete devastation. Many badly built structures have collapsed and even structurally-sound buildings are affected. Damage is recorded over an 80 km radius. Aftershocks also occur.

Electricity outage



During the summer, physical damage to the high-voltage grid causes it to fail, affecting several cantons with major agglomerations and a high infrastructure density on their respective territories. The power outage lasts between two and four days. Between 0.8 and 1.5 million people are affected in the region. It takes days and weeks to return to normality.

Animal disease



An animal disease which first appeared in surrounding countries spreads across Switzerland. The causative agent is known. The disease is highly contagious and the mortality rate among the infected animal population is high.

Comparing disaster risks in Switzerland

The risk diagram is an important outcome of the national risk assessment. At a glance, it shows the risks emerging from the assessed disasters and emergencies in Switzerland.

The expected damage and likelihood of occurrence determine the risk of a given hazard. This means that multiple hazards can be displayed and compared in a single diagram. Hazards with a moderate risk appear in the lower left quadrant of the graph, whereas those with a higher risk are shown in the upper right quadrant.

The likelihood of a hazard occurring is determined by how frequently it happens. However, there are a number of hazards that can only be assessed based on their plausibility rather than on their frequency. Therefore, the risks are presented in two separate graphs (pages 13 and 14).

Dealing with fuzzy data

The references and documentation on which the analyses are based vary from hazard to hazard. For example, there is a wealth of information and documentation on certain events like floods, storms and accidents involving hazardous material. This is due to either their relative frequency or the existence of legal provisions, e.g. the Federal Ordinance

on Major Accidents which demands robust assessments of the potential risks of hazardous goods. Other events like solar storms have rarely undergone detailed analysis, which means that there is more uncertainties about the risk estimate, in other words the data are «fuzzy».

The use of scenarios also generates a certain degree of fuzziness in that the likelihood of occurrence and the extent of damage, and thus the risk of a given hazard, are derived from a single, specifically selected and pre-defined sequence of events.

Validation of the results

The FOCP tasked the Paul Scherrer Institute (PSI) to use historical data to validate the results of the national risk assessments. The results of the modelling showed that expert estimates in the risk analysis largely match the findings of the historical data analysis and model calculations. The uncertainties associated with the adopted approach are therefore deemed to be within an acceptable limit.



Nuclear power plant accident – a subject of debate

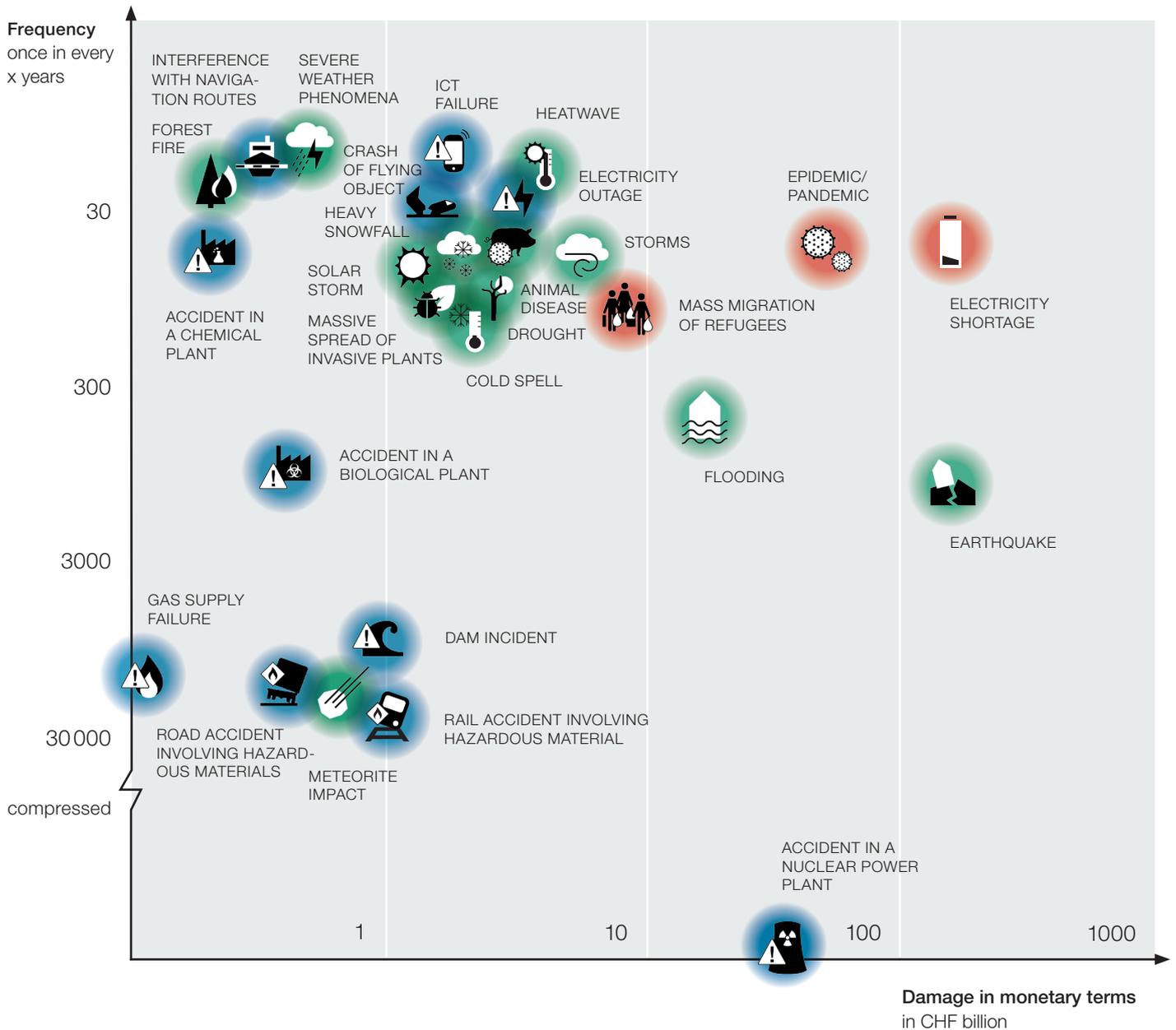
Switzerland takes contingency planning for a nuclear power plant accident very seriously. According to estimates, the damages caused by such an event involving the release of a large quantity of radioactivity would be very high. Yet, the same estimates rate the likelihood of such an event occurring as extremely low. This is primarily due to the stringent safety regulations Switzerland has in place. The nuclear power plant accident scenario is therefore assigned a relatively low risk value. In the media and political debate, the associated risk is usually perceived as much higher.

RISK DIAGRAM 1
DAMAGE AND FREQUENCY

Supporting documentation like studies, training exercise evaluations and statistical analyses already exist for most natural and technically induced hazards, and for certain societally induced events. From this information, it is possible to determine the likelihood of occurrence based on the frequency of similar events in the past (e.g. occurring, in statistical terms, every 10, 100 or 1000 years).

The risk diagram features event scenarios that are expected to occur relatively seldom but with devastating consequences. According to the diagram and based on the current assessment, the most serious risk that Switzerland faces is an electricity shortage lasting several weeks. Pandemics, earthquakes and floods also fall into this high-risk category.

Technical hazards present a relatively low risk due primarily to stringent safety regulations in place with regard to the operation of technical installations or the transport of hazardous materials.



RISK DIAGRAM 2
DAMAGE AND PLAUSIBILITY

For maliciously-induced hazards like terrorist attacks and violent unrest, it is almost impossible to estimate their frequency of occurrence because we simply cannot predict how often individuals intend to cause such incidents. This is compounded by the fact that events of this nature (e.g. radiological attack/dirty bomb) have seldom, if ever, occurred. As a result, hardly any empirical values are available. Experts therefore base their probability estimations on a detailed assessment of the prevailing circumstances. The key question here is: how plausible is it that such an event could happen in Switzerland in the near future?

Attacks with chemical and biological agents appear less plausible as conventional attacks and cyber attacks of such an intensity because their execution requires a rather large amount of time and effort, as well as considerable technical expertise.



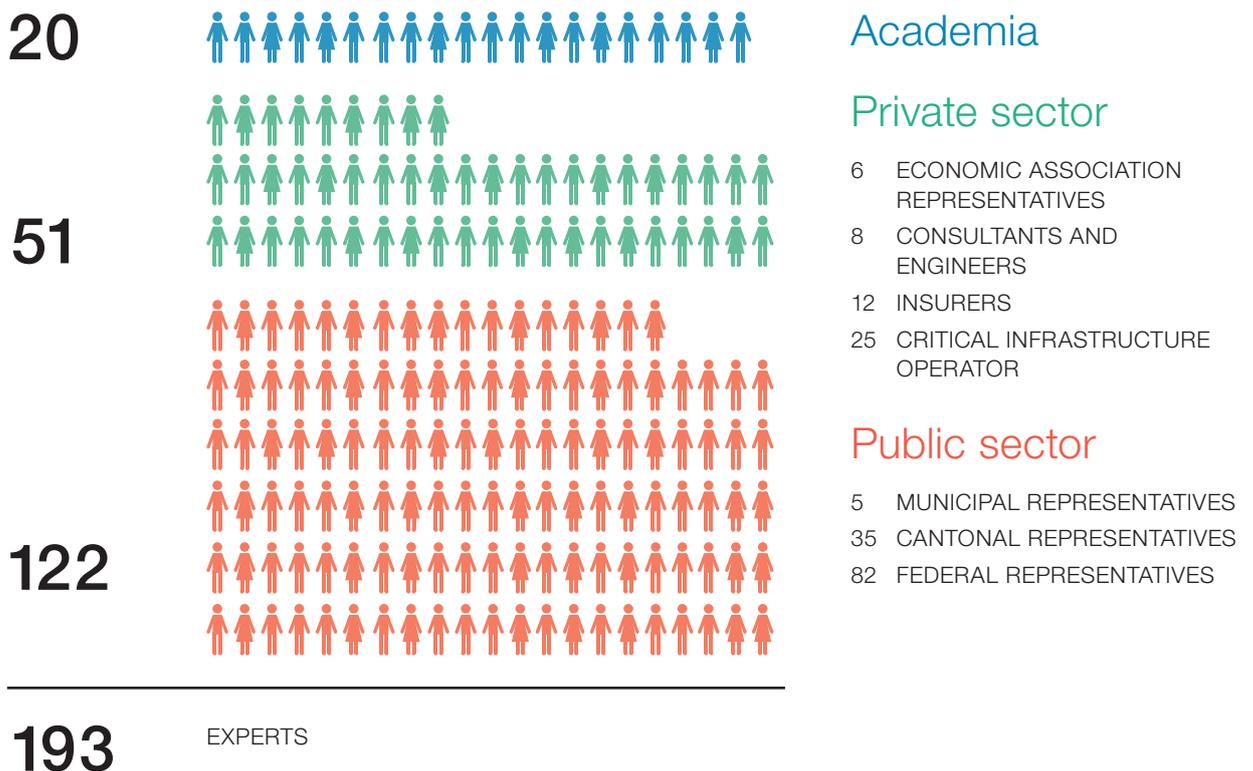
A broad-based analytical approach

Some 200 experts from Switzerland and abroad assisted the national risk assessment and provided content-related support. This broad-based approach ensures factually-sound, professional and tangible results as well as a high degree of acceptance among the involved actors.

The FOCP launched the national risk assessment and is accountable for its findings. However, the broad-based approach which was adopted ensures that the analysis not only benefits from the professional insights of the FOCP, but also from the expertise and experience of some 200 specialists from Switzerland and abroad. It is the involvement of so many external participants in the process that sets Switzerland’s national risk analysis apart. In other countries, risk assessments are usually performed by a much smaller group of experts.

The input of 200 experts, who were drawn from the federal, cantonal and municipal administrations, as well as academia and the private sector, was particularly valuable when it came to the formulation and validation of scenarios as well as the evaluation of the risk of a given hazard in the expert interdisciplinary workshops.

PROFESSIONAL BACKGROUND OF THE PARTICIPANTS



National risk assessment – process and products

The national risk assessment builds on previous risk analyses carried out by the FOCP, but is more comprehensive and broader-based than its predecessors. As a result, its products are of greater value for a considerably wider audience.



Hazard catalogue

This catalogue features some 100 hazards and incidents which Switzerland could potentially face. Within the civil protection system, it is used to select hazards for inclusion in federal, cantonal and municipal risk analyses.



Hazard files

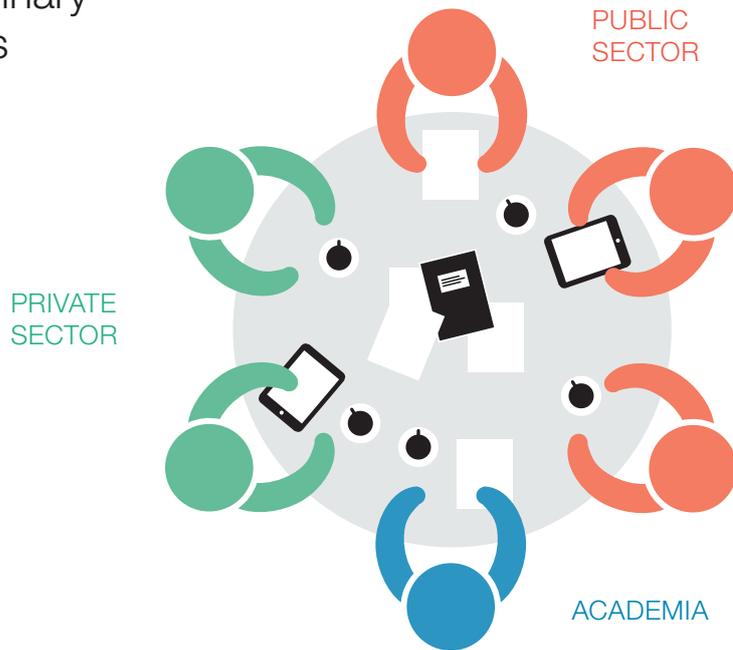
For each of the 33 hazards assessed so far, there is a hazard file which describes in detail a scenario of major intensity. It also contains information on the factors which may influence the course that such an event could take, and provides examples of previous events that have occurred in Switzerland or abroad.



Methodology report

This report provides a comprehensive description of the analytical approach. It also specifies which definition of risk was applied and explains the meaning of the chosen damage indicators.

Interdisciplinary workshops



SCENARIOS AND
IMPACT DIAGRAMS

FREQUENCY AND
PLAUSIBILITY

RISK DIAGRAM



Risk report

The risk report is the main product of the national risk assessment. It sets out the background, methodology and results of the analysis. It also explains how future disaster management efforts in Switzerland can build on these results and how the national risk assessment process will be continued.



Website

All the mentioned products generated by the national risk assessment are available to download from www.risk-ch.ch.

Foundations of disaster management

The national risk assessment answers two key questions: «What could happen?» and «What will the damage be?» It also provides valuable information on how Switzerland can best protect itself from such risks.

Forward-looking planning, so-called preparedness planning, is an important instrument in the civil protection system. It enables a rapid and effective response to an event and improves the resilience of a community.

The products of the national risk assessment are therefore key references for this work. Future risk analyses can adopt the same methodology and build on the achievements. As a result, preparedness planning in Switzerland will ultimately become a holistic and consistent process.

Identify shortcomings and plan adequate measures

The findings of the national risk assessment are a prerequisite for two major pieces of follow-up work: hazard-specific capability analyses and a general hazard capability analysis. The aim of these analyses is to determine whether the Swiss civil protection system is effective and fit for purpose. The results of the national risk assessment can be used to ascertain whether a community is in a position to cope with several different events. In turn, this will highlight any shortcomings in preparations for the given event and identify the action that needs to be taken to remedy the situation. The general hazard capability analysis will help answer questions like what level of stockpiling is necessary and what is the adequate level of service for communications equipment used by the first responders, for example.



Preparedness planning

In Switzerland, the NBCN Crisis Management Board is responsible for national preparedness plans related to nuclear, biological, chemical and natural events. Its members are drawn from several federal offices and it works closely with cantonal stakeholders and the private sector. The products generated by the national risk assessment provide the national Crisis Management Board with a standardised framework.

At cantonal level, the civil protection command bodies are responsible for drawing up preparedness plans. They can use the products of the national analysis (hazard files, methodology report) to assist their own work and compare the results of their risk analysis with those of the national risk analysis. As a result, the task of the cantons is made easier and Switzerland moves a step closer to a consistent preparedness planning process at cantonal level.

Looking ahead

The national risk assessment will be reviewed and updated periodically. Specialists from various fields, the political community and society as a whole are invited to join in the risk dialogue and broadly discuss how the findings can be implemented.

Disaster management is a continuous process. The population and their livelihoods are exposed to evolving and often aggravating hazards. It is therefore crucial that the existing planning foundations are continually updated and adapted.

With this in mind, the following action will be taken periodically:

- **Review of the selected hazards**
Are the selected hazards still relevant? Should new hazards be investigated?
- **Update of risk landscape**
Are the risk assumptions still valid? Has there been any change in terms of frequency of occurrence and extent of damage?
- **Further development of the methodology**
While the methodology is robust and broad-based, periodic improvements may be necessary. To this end, it should be clarified how different hazards interact with each other. For example, how would a drought affect the electricity supply? How can we estimate in more a systematic way the plausibility of a maliciously-induced hazard?
- **Review of products**
Are the products generated by the national risk assessment still up-to-date? Are changes or additions needed?

The updated products will be published periodically alongside a revised version of the risk report.

Robust preparedness more important than ever

Population and infrastructure density in Switzerland continues to grow. Global trends like climate change also affect our hazard landscape. As a result, robust and forward-looking preparedness planning will become increasingly important. With its national risk assessment, the FOCP provides a sound and useful foundation for disaster and emergency preparedness planning in Switzerland.



Risk dialogue

The aim of civil protection is to cope with disasters as effectively as possible. However, absolute security is not a realistic and achievable goal. Based on economic, ecological and societal arguments, the implementation of all conceivable measures to eliminate the risks identified or to prepare for all the consequences is not possible. This is why it is so important that a dialogue takes place between the different stakeholders (e.g. society, political decision-makers, specialists) on the scale of damage Switzerland is willing to accept and on the price it is willing to pay to increase the level of security.

