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Report on Risk Analysis in Civil Protection 2012

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Preamble

The task of civil protection is to protect the population, their homes and workplaces, vital or defence-important civilian services, companies, facilities and plants, as well as the environment and cultural heritage from damaging events and to eliminate or mitigate their consequences. Germany has an efficient, integrated assistance system that has proven its worth in the field and can cope with events that go beyond the scope of everyday emergency response. At the same time, society is confronted with a series of potential hazard events, the intensity of which would also present major challenges for German civil protection. It must be acknowledged that risks remain from which it may not be possible to provide adequate protection.

If the question 'How can the state guarantee demand- and securityoriented prevention and defence planning in civil defence and disaster control' is to be answered adequately, a well-founded risk analysis is required as a basis. [1] This serves the purpose of dealing in a forward-looking and structured manner with potential dangers of relevance to the Confederation and the effects to be expected on the population, its livelihoods and public safety and order in Germany when they occur.

The aim of risk analysis in civil protection is to provide a comprehensive, comparative overview (risk portfolio2) of different risks and events with regard to their probability of occurrence and the extent of damage to be expected when they occur. In order to be able to depict these two variables and represent them relative to each other in a risk matrix, a suitable classification must be defined beforehand. This is a tool for assigning a relative magnitude to the risk under consideration. To this end, it is also necessary to include information on the number of people potentially affected. The classifications attached to this report in Annexes 1 and 2 apply exclusively to risk analysis at federal level. They do not yet contain any evaluative consideration of certain hazards or events, but are rather a prerequisite for a differentiated risk assessment, which must follow the risk analysis.

The risk analysis is carried out on a professional basis. It is to be understood as a factual and sober stock-taking of what is to be expected when different dangers occur in Germany. It does not anticipate either the prioritisation of individual scenarios or a political assessment of risks or precautionary measures to be taken. Their results should rather serve as a basis for information and decision-making, and thus enable improved, risk and needs-oriented precautionary and defence planning in civil defence and disaster control.

In contrast to technical risk analysis, risk assessment is a political process that also takes into account social values and the respective risk acceptance. After a risk analysis has been carried out, a risk assessment must be carried out by the levels of administrative and political responsibility. Risk assessment is a procedure by which a) it is determined to what extent the previously defined protection goal is achieved in the event of an event, by means of which b) it can be decided which remaining risk is acceptable and by means of which c) it is decided whether measures can or must be taken to minimise it. [3] Protection objectives relate to the extent and quality of the various objects of protection to be protected and the extent to which capabilities for coping with possible damage must be provided. On the basis of a risk portfolio that is as comprehensive as possible, risks and protection goals can be compared in order to identify possible deficits. Thus, within the framework of risk management, the competent authorities at federal and state level can check whether the existing capabilities are adequate to protect the population and its livelihoods, identify the need for action and take appropriate measures. This illustrates the close link between risk analysis and capability-based planning and thus between risk and crisis management. The findings of risk analysis thus contribute directly to the pursuit of a networked approach to action, which - irrespective of the cause of the respective event - promotes flexible, efficient and effective action in the event of an incident. Risk analysis is thus to be understood as a partial aspect of comprehensive risk management, which consists of the continuous identification, analysis, evaluation and treatment of risks. It is the starting point for the necessary discourse on risk assessment in politics and society and for decisions on civil protection measures.

In accordance with § 18 Para. 1 Sentence 1 of the Civil Protection and Disaster Assistance Act, the Federal Government, in cooperation with the federal states responsible for disaster control, prepares a nationwide risk analysis for civil protection. The Confederation is responsible for the protection of the population against dangers and risks arising from military conflicts and wars (Article 73 paragraph 1 number 1 of the Basic Law). In all other cases, responsibility lies with the Länder. In the spirit of the
"New Strategy for the Protection of the Population in Germany" (resolution of the 171st meeting of the Standing Conference of the Ministers and Senators of the Interior of the Länder (IMK) of 6 December 2002), the Federal Government and the Länder have agreed on the following

[1] Cf. German Bundestag: Stenographic report on the 162nd session of 1 March 2012, agenda item 11.

[2] Vgl. Center for Security Studies (CSS) der ETH Zürich, Crisis and Risk Network (CRN) 2009.

[3] Cf. Federal Office for Civil Protection and Disaster Assistance 2011.

The Committee agrees, however, that a strict division of responsibilities would be inadequate in view of the risks of national importance. The philosophy and, as it were, the central thread of the "New Strategy" is the joint responsibility of the Federal Government and the Länder for dealing with major emergencies. Joint responsibility is not understood here in the sense of new competences and legal changes or even as a joint task in the constitutional sense, but rather in a pragmatic, political sense: as cooperation in partnership across federal borders. A core element of the "New Strategy" is the improved interlocking, coordination and cooperation of the federal levels of responsibility on the basis of hazard and risk analyses.

Against this background, the Federal Government conducts cross-departmental risk analyses in civil protection. These take into account such hazards and events that have potential federal relevance, i.e. in the management of which the federal government may be required to act in a special way within the framework of its (basic) legal responsibility. [4] The Confederation's risk analyses are carried out in an abstract, generic manner. The scenarios used here cannot claim to be absolutely representative. Due to the number, type and scope of conceivable dangers and events, however, they lay the foundation for adequate risk management at the various administrative levels of the Federal Government and the Länder. In the interests of a holistic approach, they are to be supplemented by correspondingly more concrete risk analyses at state and municipal level in the respective areas of responsibility. Dealing with risks across all authorities and authorities can contribute at all levels to strengthening the protection of the population in Germany. Through the mutual exchange of experiences and knowledge, both the methodical procedure and the knowledge situation can be continuously improved.

1 Introduction

After the first two reports to the German Bundestag5 had initially set out the objectives and the method of risk analysis and explained the structures and procedures for preparing and carrying out risk analysis at federal level, the present report describes the status of the work carried out and ongoing.

Chapter 2 describes the organisational framework, the working methods of the bodies involved and the concrete development of the project.

[4] Cf. information from the Federal Government: Report on Risk Analysis in Civil Protection 2011, Chapter 3.1.2.

[5] Cf. information from the Federal Government: Report on the Risk Analysis Method in Civil Protection 2010 and information from the Federal Government: Report on Risk Analysis in Civil Protection 2011.

development of the now completed risk analyses "Extreme melt flooding from the low mountain ranges" and "Pandemic caused by virus modes SARS". It also provides an overview of the two scenarios.

Chapter 3 then presents a comprehensive concept for cross-level risk management, using the example of flood risk management.

The state of implementation of risk analysis at country level is summarised in Chapter 4, while Chapter 5 is devoted to parallel developments at international level, here using the examples of the EU and OECD.

The report concludes with an outlook on the further planned or necessary steps for the optimisation and ongoing implementation of the risk analysis in Chapter 6 The classifications used for the risk analysis at federal level to determine the probability of occurrence and extent of damage as well as the results of the first two risk analyses are attached to the report in the Annex.

2 Status of implementation at federal level

2.1 Basics and preparation

For the preparation of reliable and coordinated risk analyses at the federal level with the aim of creating a comparative overview of the risks posed by different hazards, the cooperation of all ministries and authorities concerned is necessary. Interdisciplinary and cross-authority cooperation brings together existing expertise and knowledge, preserves responsibilities and ensures interdepartmental acceptance of the results of the risk analysis. Two bodies have therefore been set up at federal level to implement risk analysis: [6]

On the one hand, the steering committee "Risk Analysis Civil Protection Federal Government" was formed, in which all relevant departments are represented and which is coordinated by the Federal Ministry of the Interior (BMI). The steering committee provides the guidelines for risk analysis at federal level. They include the selection of the damage parameters to be used, the determination of the classifications for determining the probability of occurrence and extent of damage as well as the selection of the hazards to be investigated within the scope of the risk analysis. In addition, the Steering Committee evaluates the results and findings produced by the working group with a view to the need for action to be derived from them, approves the annual report to the German Bundestag and determines the further procedure within the framework of the federal risk analysis. Regular meetings ensure the current status of the situation at the resort level.

[6] Cf. information from the Federal Government: Report on Risk Analysis in Civil Protection 2011, Chapter 3.1.1.

On the other hand, a working group was formed, consisting of mandated divisional authorities of the relevant departments and coordinated by the Federal Office for Civil Protection and Disaster Assistance (BBK) in consultation with the FMI. The Working Group develops scenarios for the hazards selected by the Steering Committee and carries out the corresponding risk analyses for these hazards on the basis of the Steering Committee's instructions. In this process, existing knowledge and information from the business area authorities are already being brought together. The analyses are carried out in hazard-specific working groups consisting of representatives of the competent authorities and, where necessary, supplemented by expertise from other areas. The working groups are headed by the divisional authority responsible for the respective area ("risk owner principle").

In preparation for the risk analysis at federal level, the steering committee first established the necessary basis. Hazards and events with potential federal relevance, which would place great demands on the structures of the German civil protection system, were identified7 and prioritised in the risk analysis with regard to their sequence of processing. In addition, the steering committee selected the damage parameters to be used in the risk analysis to reflect the areas of HUMAN, ENVIRONMENT, ECONOMY and IMMATERIAL and defined the classifications for determining the probability8 and extent9 of damage. Here it should be pointed out once again that the classification of the extent of damage does not include any evaluative consideration, but is a tool for the relative representation of the magnitude of the event with regard to the expected extent of damage for the respective damage parameters.

In 2012, risk analyses were carried out at federal level for the hazards/events "flooding" and "extraordinary epidemics". The processing was carried out in two hazard-specific working groups, which were composed of the relevant authorities of the working group and coordinated by the BBK. In the first step, the working groups each developed a proposal for the concretization of the initially abstract hazards/events "flooding" and "exceptional epidemics". After the proposals had been approved by the steering committee, the respective scenario was then developed in the working groups, which formed the starting point of the risk analysis and the basis for determining the probability of occurrence and the expected extent of damage for the underlying event. Besides a comprehensive description of the assumed course of events, such a Scenario Statements on expected impacts on Critical Infrastructures and the supply of important goods and services to the population, as well as statements on the expected impacts on the protected goods, which are taken into account in the risk analysis. It also includes a list of reference events, relevant literature and further information. Since the respective scenario implicitly determines the result of the risk analysis by the chosen characteristic of the event, its careful and consistent design is of particular importance for the preparation of reliable risk analyses. When the scenarios were drawn up, it was also important to ensure that they were sufficiently concrete to achieve reliable results of the risk analyses, but at the same time practical and not too detailed for the analyses from the federal perspective. Scenario development was based on the comprehensible/plausible assumption of the most unfavourable course of an event (known in international parlance as a "reasonable worst case"). The draft scenarios prepared in this way were approved by the Steering Committee.

Subsequently, the risk analyses were carried out and the probability of occurrence and extent of damage were determined using the classifications defined by the steering committee. The results of the two risk analyses were presented and discussed in both the working group and the steering committee. Suggestions from both bodies were taken on board and have been incorporated into the finalisation of the analyses and documents. The results of the risk analyses were then prepared for the present report.

2.2 Risk analysis "Extreme melt water from the low mountain ranges

The risk analysis "Extreme melt floods from the low mountain ranges" was carried out under the technical leadership of the Federal Institute of Hydrology and with the participation of other federal authorities10 .

First, a scenario was developed by the inter-agency working group. From the multitude of possible flood events that can occur in Germany, an event of the type "snowmelt flood" was selected for this purpose, as this has often occurred in history, affects the majority of river basins in Germany and has a correspondingly large potential for damage. [11] Due to the combination of different

[7] Cf. information from the Federal Government: Report on Risk Analysis in Civil Protection 2011, Chapter 3.1.2.

[8] See Annex 1.

[9] See Annex 2.

[10] including the Bundeswehr Geoinformation Office, the Federal Office for Civil Protection and Disaster Relief, the Federal Agency for Nature Conservation, the Federal Maritime and Hydrographic Agency, the Federal Office for Safety in Information Technology, the Federal Institute for Geosciences and Raw Materials, the Federal Institute for Agriculture and Food, the Federal Institute for Materials Research and Testing, the Federal Agency for Technical Relief, the Federal Network Agency, the German Weather Service, the Armed Forces Support Command of the Bundeswehr, the Federal Environment Agency.

[11] See Deutsch, Glaser and Pörtge 2010.

s a result of weather patterns that have already occurred in the past in this form - although not yet in immediate succession - an extreme meltwater flood was generated, which is both relevant and plausible for Germany. [12]

The scenario describes a situation in which, due to long-lasting, unfavourable weather conditions in late winter/spring on the Ems, Weser, Elbe, Rhine, Oder and Danube and their tributaries, a snowmelt flood occurs in two waves. This is triggered by strong thaw in the catchment areas with a high proportion of low mountain ranges in combination with high precipitation. Water levels have risen sharply over a period of two months and in many places exceed a 200-year recurrence interval (HQ200). Structural flood protection facilities are flooded or do not withstand the enormous loads, massive flooding occurs along the river courses. Several large cities are also affected by this. A sufficiently long advance warning time enables the authorities and the population to prepare for the event. Evacuations are ordered on a large scale, and emergency forces from the police, fire brigade, aid organisations, the German Federal Agency for Technical Relief and the German Federal Armed Forces are in continuous use. In the flood area and partly in the bordering back country, the electricity, gas and water supply often fails, but there are no widespread failures. The discontinuation of inland waterway transport and the impairment of road and rail transport have noticeable effects on the logistics sector in the whole of Germany. Such a river flood is part of the natural water cycle and, especially in its extreme form, has considerable effects on all areas of protected assets considered in the risk analysis.

For this scenario, both the probability of occurrence of such a flood event and the extent of damage to be expected when it occurs were then determined using the method of risk analysis for civil protection at federal level. The results of the risk analysis (probability of occurrence, extent of damage, scenario) are attached to the report in Annex 3.

2.3 Risk analysis "Pandemic caused by Virus Modes SARS"

The risk analysis "Pandemic by Virus Modes-SARS" was carried out under the technical leadership of the Robert Koch Institute and with the participation of other federal authorities13 .

Here, too, a corresponding scenario was initially worked out by the inter-agency working group. Subsequently, the probability of such a pandemic occurring and the extent of damage to be expected when it occurs were determined.

The scenario describes an exceptional epidemic event based on the spread of a novel pathogen. For this purpose, the pathogen, which is hypothetical but has realistic properties
"Modi-SARS" as a basis. The choice of a SARS-like virus was made partly because the natural variant in 2003 quickly pushed very different health systems to their limits. The past has already shown that pathogens with novel properties that trigger a serious epidemic event can suddenly appear (e.g. SARS coronavirus (CoV), H5N1 influenza virus, Chikungunya virus, HIV). [14] Using simplified assumptions, the hypothetical course of a pandemic in Germany was modelled for this mode SARS virus, which is both nationally relevant and plausible. [15]

The scenario describes a worldwide spread of a hypothetical new virus originating in Asia, which is given the name Modi-SARS virus. Several people enter Germany before the authorities receive the first official warning from the WHO. Among them are two infected persons who, through a combination of a large number of contact persons and high infectivity, strongly contribute to the initial spread of the infection in Germany. Although the measures provided for in the Infection Protection Act and pandemic plans are being implemented quickly and effectively by the authorities and the health system, the rapid spread of the virus cannot be effectively halted due to the short interval between two infections. At the climax of the first wave of the disease after about 300 days, about 6 million people in Germany are affected by Modi-SARS. The health system is faced with immense challenges that cannot be overcome. Assuming that top priority is given to maintaining the function of vital infrastructure and that key positions remain occupied, large-scale supply disruptions in other infrastructure sectors can be avoided. After the first wave subsides, two more, weaker waves follow until a vaccine is available three years after the first diseases appear. The special thing about this event is that it covers the entire area of Germany and all of its people.

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[12] The water balance model LARSIM-ME (Large Area Runoff Simulation Model Central Europe) was used for this purpose.

[13] including the Federal Office for Building and Regional Planning, the Federal Office for Civil Protection and Disaster Relief, the Federal Office for Information Security, the Federal Agency for Agriculture and Food, the Federal Agency for Technical Relief, the Federal Network Agency, the Paul Ehrlich Institute, the Armed Forces Support Command of the German Federal Armed Forces.

[14] A current example of a newly emerging pathogen is a coro- navirus, which is not closely related to SARS-CoV. This virus has been detected in six patients since summer 2012, two of whom have died (as of November 26, 2012).

[15] A Susceptible-Infected-Recovered (SIR) model, which was created with Stata 12 software, was used for the modelling. The course of the pandemic was modelled on population density.

secondly, it occurs over a very long period of time. In the event of such a pandemic occurring, an immensely high number of victims and serious effects on different areas of protected assets would have to be expected over a period of three years with three separate waves.

For this scenario, both the probability of occurrence of such an epidemic event and the extent of damage to be expected when it occurs were then determined using the method of risk analysis for civil protection at federal level. The results of the risk analysis (probability of occurrence, extent of damage, scenario) are attached to the report in Annex 4.

3 Excursus: Cross-level risk management using the example of floods

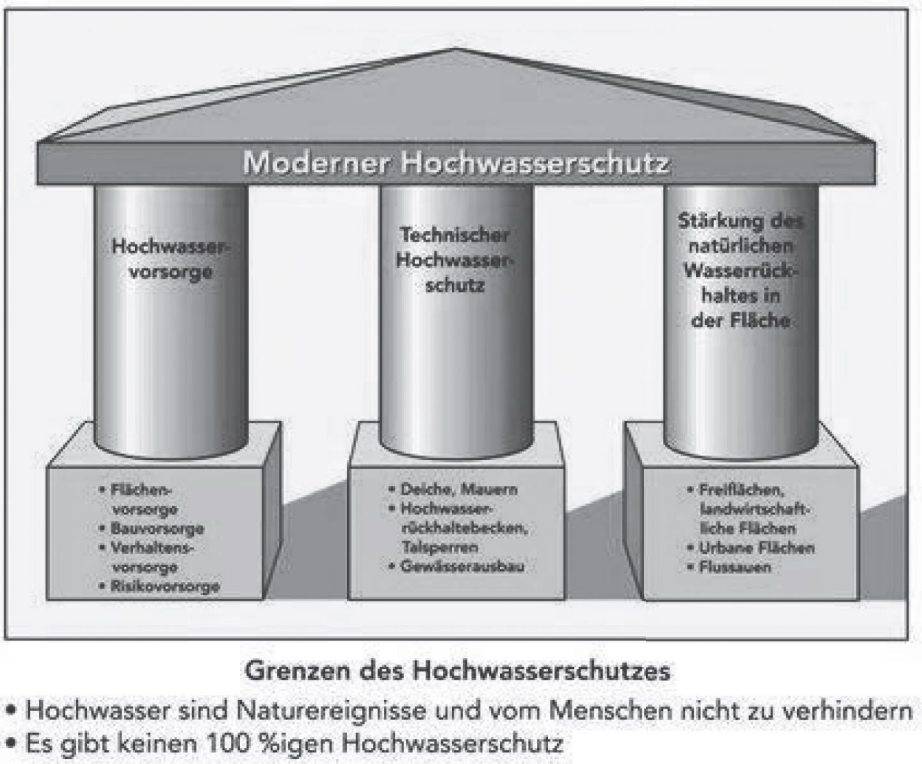
Flood protection has a very long tradition in Germany. Technical protection measures, such as dike construction, have been known for several hundred years. The first successful attempts to keep flood plains clear are to be found, for example, in the Prussian Laws of 1905.

Numerous flood events in recent decades have led to a continuous expansion of the catalogue of flood protection and flood prevention measures. The basis of earlier flood protection concepts was mostly a static flood protection approach, i.e. the focus was on "technical flood protection". In the last 20 years, this approach has been extended to comprehensive flood protection. This is based on three pillars: technical flood protection, flood prevention and "natural support". All known measures of flood protection and flood prevention can be integrated into this 3-pillar concept, see Figure 1, thus ensuring very comprehensive preventive flood protection.

Until then, the term "risk" had only been anchored in the context of risk provisioning, i.e. the predominantly financial provisioning of those affected,
z. B. by taking out insurance. In the past decades, the insight has only gradually become established that a dike cannot lay an area "free of high water" and that there is always a risk that the dike will fail.

From picture 1

3-pillar concept of modern flood protection16



[16] Cf. Ministry of Agriculture and Environment of Saxony-Anhalt 2010 (graphic also available online at http://www.sachsen- anhalt.de/index.php?id=13429, last accessed on 26 October 2012)

The floods of 2002 in the Elbe and Danube catchment areas reinforced existing approaches to flood protection, which made it clear that there is a need for further discussion:

a) There is no one-hundred percent protection behind dikes and other technical protection facilities.

b) The aim should be flood protection that allows people to live with the river and the flood risk.

c) The flood awareness of the population plays a major role in flood prevention.

d) Flood protection takes place at the level of river basins, within which the flood risk should not be shifted.

At European level, this discussion led to the 2007 EC Directive on the assessment and management of flood risks (2007/60/EC). This High Water Risk Management Directive (FRMD) comprises three steps:

1. Assessment of the preliminary flood risk (completed in March 2012)

2. Development of flood hazard and flood risk maps (by December 2013)

3. Development of flood risk management plans (by December 2015)

The basic idea of risk management runs through all three processing steps. In the preliminary flood risk assessment, not only the flood risk is assessed, but also the probability of damage to human health, economic activity, environment and culture. The flood hazards and flood risk maps show not only the risk of flooding but also the risk of flood damage, the number of people affected and relevant industries that could become a threat to the environment in the event of flooding. The development of flood risk management plans is based on the flood risk management cycle.

Compared to the three-pillar concept, flood risk management now also takes into account the management of a flood event, i.e. preparing for an event with the measures of hazard prevention and civil protection becomes more important and calls for a stronger link between flood risk management and the prevention of floods.

The responsible authorities and support organisations are to be set up (see Figure 2). After a flood event, a readjustment of the precautionary measures is necessary. This holistic approach creates a stronger link between the actual flood prevention and protection measures and the management of the event. The FRMD further underlines this cyclical and dynamic understanding by stipulating that the above three steps must be reviewed after six years in each case.

This enables us to react to current developments and new findings, e.g. also from the discussion on climate change, and to make adjustments. In addition, the implementation of the FRMD requires the binding nature of river basin management and cross-border cooperation.

With the amendment to the Federal Water Act (WHG), which came into force on 1 March 2010, the provisions of the FRMD have been transposed into German law. After implementation at Länder level, these have begun with a wide range of measures. The preliminary flood risk assessment has been completed and was reported to the EU Commission at the end of 2011. Work is currently concentrating on the preparation of flood hazard and flood risk maps. In parallel, the development of the first model flood risk management plans was completed. International coordination and cooperation in transboundary river basins will continue to be carried out by international commissions (e.g. ICPE, ICPR etc.).

The implementation of the FRMD in German law is a decisive step towards anchoring the holistic approach to risk management. The following points are still outstanding for the improvement of individual components of flood risk management:

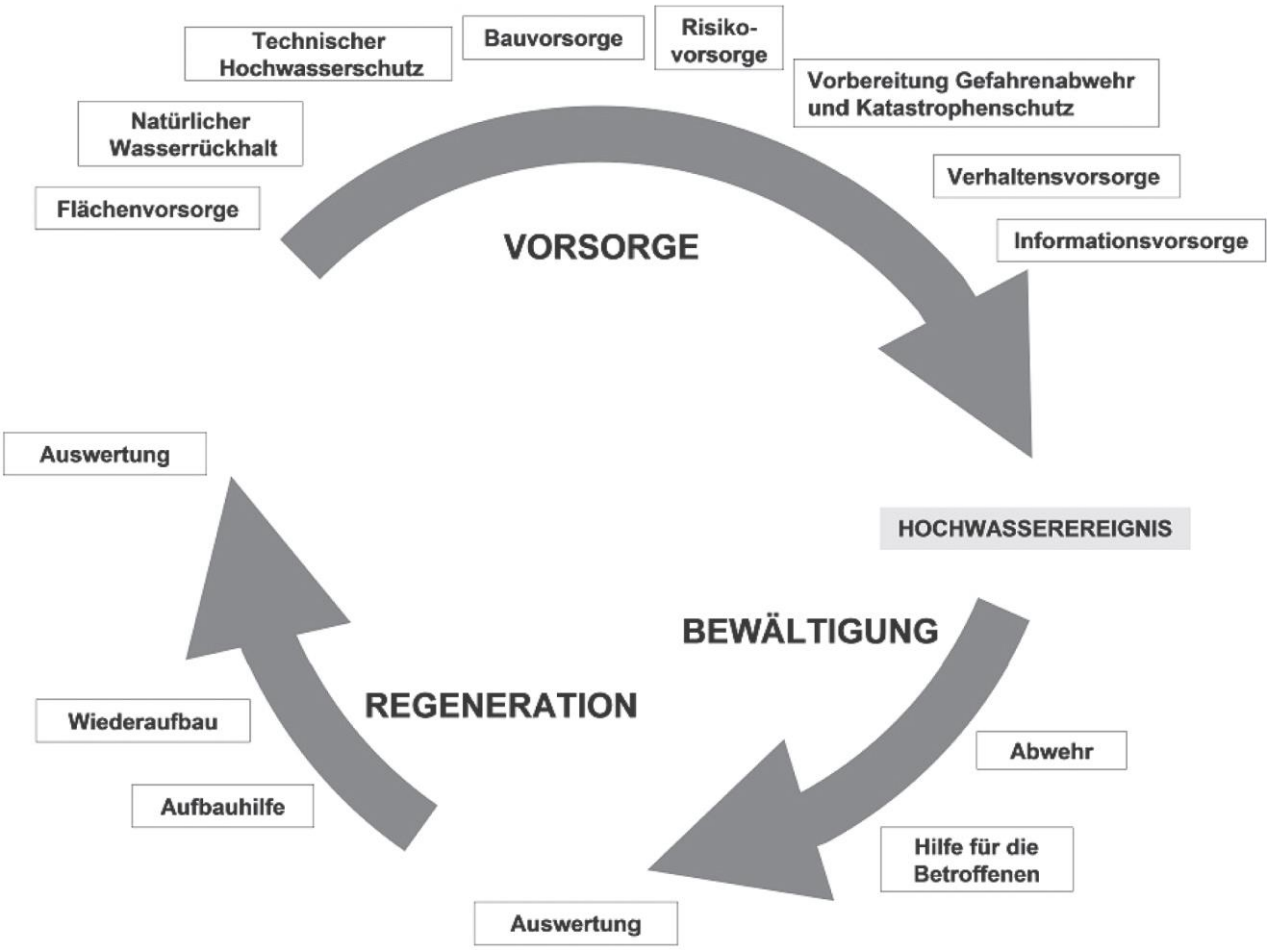
– Improvement of risk communication and strengthening of private provision,

– Improvement of damage monitoring and damage analysis in order to be able to derive more differentiated protection levels if necessary,

Support for decision-making at the municipal level in order to use long-term development potential and short-term developments
z. B. in flood plains.

From picture 2

Flood risk management cycle17



4 Status of implementation at Länder level

The cooperation between the Federal Government and the Länder takes place within the framework of the constitutional distribution of responsibilities. Since 2009 there has been a regular technical exchange (specialist conference of the federal states) with representatives of the state interior ministries and senates to carry out risk analyses at the various administrative levels.

Several federal states are currently conducting risk analyses for civil protection according to the method developed by the BBK in the form of pilot projects. The responsibility for the risk analysis within the pilot projects lies with the respective country or the respective independent city/county. In the context of the implementation of the method developed by the BBK risk analysis, including the implementation of risk analysis at all administrative levels, findings are gained which can be incorporated into the implementation process, taking into account the interests of the federal and state governments.

The scenarios on which the two risk analyses to be carried out at federal level in 2012 are based were already made known to the authorities responsible for disaster control in the countries during the risk analyses.

In addition, the Länder were also informed by the respective expert committees - for the risk analysis "Extreme melt flooding from the low mountain ranges" by the Standing Committee on Flood Protection and Hydrology of the Federal/Länder Working Group on Water (LAWA), and for the risk analysis "Pandemic caused by Virus Modes-SARS" by the Working Group on Infection Control (AG I) of the Working Group of the Supreme State Health Authorities (AOLG).

[17] Cf. Federal Government/Länder Working Group on Water, Standing Committee "Flood Protection and Hydrology" 2010.

5 Parallel development at international level

5.1 EU

The European Commission is currently preparing to draw up a cross-sectoral overview of the main risks that the EU can expect in the future. In this context, the joint exchange of experience between Member States will be supported and cooperation between relevant scientific institutions and policy makers will be encouraged. Germany is actively accompanying this process,
z. B. by participating in meetings of experts organised by the EU Commission and preparing the relevant documents. These include, for example, the guidelines on risk analysis and risk mapping for disaster management, which the European Commission has drawn up in cooperation with the Member States. [18] At the same time, the European Commission is currently preparing legislative proposals to improve the coordinated approach in this area.

Germany attaches great importance to dealing with the development and application of risk analyses at European level. The EU Commission's bilateral and multi-lateral activities to protect the population represent the right approach to anchoring the objectives of protecting the population throughout the European Union while respecting the principle of subsidiarity and strengthening the idea of prevention throughout Europe. This includes the exchange of information and methods and best practices. In this context, the Federal Government works closely with the Member States and the European Commission. Germany is committed to establishing adequate standards of protection in Europe and represents its concepts and ideas for carrying out risk analyses, as these can make an important contribution to prevention and precaution.

5.2 OECD

The Organisation for Economic Cooperation and Development (OECD) has drawn up a non-binding framework concept for disaster-related risk assessment and risk financing at national level, which focuses on risk analysis as the basis for comprehensive risk management. [19] The approach and method proposed there is compatible with the German "Method for Risk Analysis in Civil Protection" and is based on a comparable concept of risk. The explanations on risk analysis are supplemented by a chapter on the principles of risk financing.

According to the OECD, the identification of a broad portfolio of hazards that may have a certain relevance for a country's disaster preparedness (including those that are very rarely expected to occur), as well as the systematic, interdisciplinary investigation of these hazards with regard to their probability of occurrence and extent of damage (risk analysis), are also the beginning of effective risk management. Furthermore, the OECD also considers the participation of ministries and authorities from the various relevant specialist areas, supplemented where necessary by representatives of other institutions, industry and science, to be useful in order to be able to draw on the broadest possible knowledge base. At the same time, an authority must be designated as the central coordinating body.

In addition to outlining the proposed approach, it also explains the challenges facing risk analysis. This includes, for example, the uncertainties associated with the estimation of the probability of occurrence and extent of damage, the limited performance of modelling programmes and the lack of a reliable data basis in many areas. Against this background, risk analysis is presented as a legitimate and valuable instrument of precaution, while at the same time being distinguished from exact science 'in the classical sense'.

In order to carry out the most comprehensive risk analysis possible, it is recommended that the results obtained at national and regional or local level be linked, and that there should be a continuous mutual exchange between the bodies involved. In addition, the importance of appropriate risk communication is made clear. Transparency, traceability and comprehensible communication of the results of risk analysis (and all other aspects of risk management) can make a significant contribution to inspiring confidence in state provision - but also in concrete measures in the event of loss - and to developing an enlightened "risk culture".

6 view from the river

The structures and procedures established at federal level have proved their worth in practice in the implementation of the first two risk analyses, "Extreme melt flooding from the low mountain ranges" and "Pandemic caused by virus mod- SARS". This applies in particular to the interdisciplinary approach and the bundling of diverse expertise through the involvement of numerous federal authorities.

In this context, it is pointed out that the Federal Government's risk analyses are deliberately carried out pragmatically in order to achieve results within a manageable period of time on the basis of the findings available in the participating authorities. A central challenge here is to find an appropriate balance between the practicability of the analyses and the reliability of their results. So

[18] See European Commission 2010.
[19] Cf. OECD 2012.

it is not possible - but also not necessary - from the federal government's overarching perspective to assess the impacts of an event in detail at a small or even very small scale, and thus to make statements on the damage, failures or disruptions that could be expected on site. This can only be determined at the respective administrative level in the own area of responsibility. At the same time, the analysis from a federal perspective also requires a fundamental understanding of some local processes in order to be able to assess on a generalised level whether and how an event could have an impact nationwide. This applies, for example, to the supply of the population with services and goods through critical infrastructures in the event of an incident.

Aspects on which no reliable and sufficiently detailed information is available to date must first be approached with the help of assumptions and expert assessments. The first two risk analyses have made it clear that on certain points there are sometimes no reliable findings at the level of the federal authorities involved or that relevant data are not currently available. For example, in order to estimate the impact on the areas of "CRITIS/provision" and
The "national economy" is conducive to the assessments of infrastructure managers and companies in order to be able to make more reliable statements about the consequences to be assumed for the event in the area on which the scenario is based. In the future, the integration of institutions from research and science should also be aimed at in order to supplement expertise and validate results. In this way, the common knowledge could be continuously improved and used for a wide range of purposes in the respective areas of competence.

In addition, the implementation of risk analysis can be supported by the use of appropriate tools (in particular models). Important here are transparency and comprehensibility. In this context, the use of geoinformation technology holds great potential, because in combination with the corresponding analysis competence, geoinformation and the associated technical infrastructures are valuable planning aids for population protection. In future, the federal government's risk analysis is to be supported to a greater extent by geodata and the information produced with it, which is tailored to requirements. These include, for example, maps that show how the various objects of protection are distributed over the territory of the Federal Republic of Germany, where the occurrence of different hazards is to be expected and at what intensity, and where areas are particularly susceptible to damage.

Of central importance in this context is the availability and intelligent linking of relevant geodata. For this purpose, it is necessary to bring together the geoinformation available at different locations with relevance for population protection in a targeted manner and to make it usable for risk analysis. This is where the Act on Access to Digital Geodata (Geodatenzugangsgesetz - GeoZG), which serves to implement the European INSPIRE Directive20 and is closely linked to the activities undertaken jointly by the federal government, the states and the municipalities since 2004 to build up the Geodata Infrastructure Germany (GDI-DE). According to the GeoZG, the geodata and geodata services of the federal government, including the associated metadata, are to be made available free of charge for commercial and non-commercial use and further use in the future, unless otherwise stipulated by special legal provisions and unless contractual or legal rights of third parties conflict with this. [21] This is in line with the idea of open government and open data, which is also supported by the German government. In this context the central German tracing service "Geodatenkatalog-DE" is of great value. It brings together decentralised metadata sets of federal and state authorities and makes them consolidated and available for both GDI-DE and INSPIRE via a central catalogue interface according to the requirements of INSPIRE. Descriptive meta-information on geodata can be researched here centrally and efficiently. In addition to contact, spatial and origin information, the "Geodata Catalogue-DE" also contains information on the purposes and conditions of use of the respective geodata. The latter in particular are an important aspect with regard to risk analysis, because not all relevant geodata are actually accessible and usable.

For the purpose of the most reliable assessment possible of the expected effects of the events examined in the risk analysis, it should also be possible to tap those data sources for risk analysis in civil protection whose targeted use is not possible at present for various reasons. For example, data from official statistics that are comparable nationwide (e.g. data on population distribution, housing and workplaces) are currently only available in a spatial resolution that refers to districts or municipalities. This considerably limits their usefulness for civil protection, among other things because they are inhomogeneous in terms of their spatial extent and shape and are not constant over time. [22] The provision of statistical data on a raster basis ("geographical grid cell"), as provided for in the planned law on the promotion of electronic administration and the amendment of other regulations, would represent an important step forward and would make it possible to provide statistical data on a more reliable basis.

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[20] INSPIRE (Infrastructure for Spatial Information in Europe) is a directive of the European Commission for the creation of an infrastructure for spatial information in the European Community. The aim of the INSPIRE Directive is to make high-quality spatial data from the authorities of the Member States accessible under uniform conditions to support the formulation, implementation and evaluation of European and national policies.

[21] Section 11 (2) sentence 1 GeoZG, the recently adopted amendment to the GeoZG, which is to come into force at the end of 2012, has already been taken into account here.

[22] Cf. Heidrich-Riske 2010.

This will bring considerable added value to risk analysis and civil protection as a whole. This is especially true if this would already be applied to the current Zen sus 2011. Another example of geodata that cannot currently be used for risk analysis for reasons of usage rights is the employment statistics of the Federal Employment Agency, which would be a valuable basis for determining the economic impact of various events.

In cases where generalised statements cannot be made across the board or can only be made to a limited extent, so that sometimes simplified assumptions have to be made, the more favourable course was assumed in each case in the context of this year's two risk analyses in order to avoid unprovable dramatisations. Otherwise, the scenarios on which the risk analyses are based could also have been designed differently, which could well have led to even more drastic effects on the objects of protection under consideration. This would have been the case, for example, if it had been assumed that the flood event would additionally cause an incident in a nuclear power plant or chemical plant or if it had been assumed that several vital infrastructures could no longer be maintained as a result of the pandemic event and the associated loss of personnel. A single scenario thus represents, as it were, a point recording for an event that is assessed as plausible and could happen in the most pleasant way. However, it cannot and must not be understood in the sense of a forecast, because whether such an event actually occurs in this way or in another form is not predictable. The purpose of the risk analysis is rather to examine, on the basis of selected scenarios, whether the existing capabilities and state preparation for coping with the possible damage and effects identified in the risk analysis framework are appropriate and sufficient.

At this point it should be stressed once again that these are risk analyses from the perspective of civil protection. If necessary, these are to be supplemented by additional special analyses, especially at district and Land level; this applies both to technical concretisation (e.g. detailed analyses for a more differentiated assessment of possible impacts on different CRITIS sectors) and to spatial concretisation (e.g. detailed analyses for a more differentiated assessment of impacts at regional to local level). Findings obtained in the course of implementing the risk analysis can provide valuable information on interfaces and the need for research. Risk analysis in civil protection is also closely related to other (security) policy initiatives. These include the National Strategy for Critical Infrastructure Protection (Cabinet decision of 17 June 2009), the Adaptation Strategy to Climate Change (Cabinet decision of 19 December 2008) and the European Union's requirements in the area of preventive measures to protect the Population. [23] For these initiatives, too, a risk analysis tailored in each case to the relevant priorities can provide further important findings and serve to support decision-making on measures to protect the population against the extreme consequences of climate change, against the consequences of the failure of critical infrastructures and in the development of solution-oriented protection concepts within the framework of prevention policy at European level.

The scenarios and results of the Federal Government's risk analyses should also be made available to other users. These include, for example, the authorities responsible for disaster protection at the level of the Länder, districts and municipalities. Even beyond the actual field of civil protection, additional possible uses are already emerging at this stage. For example, the federal and state project group "Reorganisation of the legal bases of emergency food provision", which was set up by the federal and state experts responsible for emergency food provision, was informed about the methodical procedure within the framework of civil protection risk analysis and expressed interest in using the scenarios created here for its own purposes. In addition, the results of the risk analyses and the knowledge gained in their preparation will also be used in international exchanges with partner countries and the EU.

Now that the method of risk analysis in population protection has proven to be profitable and practicable in the first scenarios, work on risk analysis at federal level will be continued continuously with the close involvement of the Länder. The annual report to the German Bundestag will present the current status of the risk analysis. Gradually, the desired overview of the risk landscape will emerge. From this, concrete starting points for the tasks of civil protection at federal level are to be derived. In addition, the results of the risk analyses should be used for appropriate risk communication between the actors in civil protection and with the population. In the future, it would be advisable to carry out several risk analyses for each type of hazard in order to show the possible range of different characteristics with regard to probability of occurrence and extent of damage. For example, the risk analysis for a summer flood might lead to different results than the present analysis for the early melt flood. At the same time, a wide variety of pathogens, transmission paths and courses of events are conceivable for the danger of 'exceptional epidemic events', which would also lead to different results. In the future, combinations or concatenations of events caused by different hazards should also be taken into account in the risk analysis

[23] Cf. information from the Federal Government: Report on the Risk Analysis Method for Civil Protection 2010, Chapter 5.1.

because the effects are much more severe. Although the corresponding probabilities of occurrence of such events are considerably lower, their occurrence is nevertheless possible at any time, as the catastrophic event of Fukushima has impressively proved.

The insights gained from the risk analysis form the starting point for a holistic risk and crisis management, which must also include a corresponding discussion in society as a whole. While the analysis of risks is a technical process, the assessment of risks and the subsequent consideration and selection of, for example, risk-reducing measures are determined to a considerable extent by political and social aspects. Consequently, a corresponding dialogue must take place between the specialist authorities, science, politics and the public. In this context, it is imperative to define protection objectives so that the results of the risk analyses can be compared with these and possible deficits identified. This will also make it possible to determine whether the integrated system of population protection in Germany is adequately dimensioned and prepared for all expected damage situations, or whether there is a need for action on the part of the federal, state and local authorities, and if so, where.

In the Committee for Education, Research and Technology Assessment of the German Bundestag, the issue of protection goals has already been addressed in connection with the TA project: Endangerment and Vulnerability of Modern Societies - using the example of a large-scale and long-term power supply failure. [24] In its 162nd session, the German Bundestag also dealt with both the report on the TA project25 and the first two reports on risk analysis in civil protection. [26] Across the political groups, both topics were given a high priority and the work presented was judged to be correct and groundbreaking. Given the vulnerability of society to power failures and other hazards, the importance of early and serious employment was stressed.

[24] Cf. websites of the German Bundestag (http://www.bundestag.de/dokumente/textarchiv/2011/34457220_kw21_pa_bildung_forschung/index.html, last accessed on 26 October 2012).

[25] Cf. report of the Committee for Education, Research and Technology Assessment (18th Committee) according to § 56a of the Rules of Procedure: Technology Assessment (TA). TA project: Endangerment and vulnerability of modern societies - using the example of a large-scale and long-lasting power failure in 2011.

[26] Cf. German Bundestag: Stenographic report on the 162nd session of 1 March 2012, agenda item 11.

This is emphasised by the fact that the issue is being addressed and the population is being made more aware of it.

Particularly with regard to practical hazard prevention, it is important that protection goals are formulated in concrete terms, since precautionary measures and coping strategies can only be implemented, reviewed, discussed and adapted by means of measurable targets. [27] Here there is still a clear need for preparation and coordination, because in the case of a federally relevant damage event, protection goals that are valid for normal everyday life may no longer be guaranteed by the state. Other administrative levels/responsibilities must also be taken into account, e.g. in order to derive which capabilities the federal government must be able to provide in the event of a deployment. A corresponding horizontal and vertical networking of the respective levels is therefore of great importance. There is a continuous exchange between the Federal Government and the Länder.

In conclusion, it should be emphasised once again that risk analysis in civil protection is a permanent task and should be understood as a process. If risk analyses are carried out at all administrative levels in the respective area of responsibility and the experience and knowledge gained are exchanged, the comprehensive consideration and adequate treatment of the identified risks is placed on a broad basis and the possibility is opened up to strengthen the protection of the population in Germany where necessary. In addition, individual risk analyses can be carried out in close cooperation between the Federal Government and the Länder, if the scenario under investigation requires this from a technical point of view.

Findings, data used and methodological procedures must be regularly reviewed, updated and, if necessary, adapted to new framework conditions. If necessary, additional scenarios for newly identified hazards must be developed. Gaps in knowledge can be closed through targeted research projects. In this way, a realistic assessment of current risks can be made, which, depending on the measures already taken in the context of risk and crisis management, leads to an improvement in the risk landscape. The cooperation of citizens, science, industry, politics and authorities at federal and state level, which is shown here in perspective, will contribute to reducing Germany's vulnerability to hazards and possible disasters to a jointly supported level.

[27] Cf. Gullotta 2007.

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Annex

Annex 1

Risk analysis Federal civil protection - classification of probability of occurrence

Probability classes:	
A:	**extremely unlikely** an event which statistically occurs generally once in a period of more than 10,000 years
B:	**unlikely** an event which statistically occurs generally once in a period of 1,000 to 10,000 years
C:	**conditionally probable** an event which statistically occurs generally once in a period of 100 to 1,000 years
D:	**probably** an event which statistically occurs normally once in a period of 10 to 100 years
E:	**more than likely** an event which statistically occurs normally once in a period of 10 years or more

Hint:

These are statistical annual values, which are to be understood in such a way that with increasing rarity the expected intensity of the event also increases. For example, a 10-yearly storm event is expected to cause less damage than a 100-yearly one. However, statistical annuality does not indicate the time intervals at which such an event actually takes place. For example, it is possible that within a decade several events of the order of "100-yearly" occur (example: "the flood of the century" of the Rhine in Cologne in 1993 and 1995).

Annex 2

Risk analysis Federal civil protection - classification of extent of damage

Clues:

The classification of the extent of damage is used for the risk analysis of civil protection at federal level. The focus is thus on civil protection on the one hand (i.e. for other purposes, e.g. environmental protection, different thresholds might have to be selected depending on the focus and protection objective). On the other hand, the focus is on the federal view (i.e. at the level of the Länder/counties/municipalities, correspondingly adjusted thresholds would have to be chosen if necessary).

Any event that leads to injuries or even deaths, causes damage to the environment, infrastructure and/or residential property and may have other effects on the population, their livelihoods and public safety and order is particularly tragic for those directly affected. This is by no means to be negated by the classification used. Rather, it is used in the context of risk analysis as a tool for assigning a relative magnitude to the hypothetical event described in the scenario in relation to the extent of damage to be expected when it occurs.

It is possible to supplement the classification for certain damage parameters with additional correction factors in order to allow a more differentiated derivation of the respective extent of damage. The practicability of the implementation and the reliability of the results must be weighed up.

The risk analysis shall document the extent to which the determination of the extent of damage takes into account damage that does not result directly from the event itself but indirectly as a result of the event (e.g. injuries or deaths caused by an evacuation measure in connection with the event under consideration).

Protective good HUMAN

Damage parameters: Dead (M1)

Extent of damage classes:

A: ◎ 10

B: > 10 - 100

C: > 100 - 1.000

D: > 1.000 - 10.000

E: > 10.000

Note:

Persons are considered here whose death - regardless of the time of its occurrence - is causally attributable to the damaging event.

Damage parameters: Injured, sick (M2)

Extent of damage classes:

A: ◎ 10

B: > 10 - 100

C: > 100 - 1.000

D: > 1.000 - 10.000

E: > 10.000

Note:

Persons are considered here who are injured by the event in the reference area or who fall ill in the course of the event or as a result of it in such a way that they require medical or health care (here, late effects/long-term damage must also be taken into account).

Damage parameters: People in need of help (M3)

Extent of damage classes: A:

10,000 forU 1 :RFKH

B: 100,000 IU 1 :RFKH
RGHU 10,000 IU 1 - 4 weeks

C: 1.000.000 IU 1 :RFKH RGHU
100.000 IU 1 - 4 weeksRGHU
10.000 IU ! 1 0RQDW

D: ! 1.000.000 IU 1 :RFKH
RGHU 1,000,000 IU 1 - 4 weeks
RGHU 100.000 IU ! 1 0RQDW

E: > 1.000.000 for > 1 week or >
100.000 for > 1 month

Note:

The persons considered here are those who are homeless as a result of the event or who need state assistance in some other form for their physical survival.

If two classes apply, the higher class must be chosen.

Damage parameters: Missing persons (M4)

Extent of damage classes:

A: ◎ 10

B: > 10 - 100

C: > 100 - 1.000

D: > 1.000 - 10.000

E: > 10.000

Note:

Persons who are considered to be permanently missing as a result of the event are

Protected good ENVIRONMENT

Damage parameters: damage to protected areas (U1)
Extent of damage classes: **A:** 0.005% GHU *HVDPWIOlFKH GHU JHVFKW]WHQ *HELHWH (HQWVSULFKW 10 NP2) **B:** > 0.005 - 0.05% of the total area of the protected areas (corresponding to > 10 - 100 km2) C: > 0**.05** - 0.5% of the total area of the protected areas (corresponding to > 100 - 1,000 km2) D: > 0.5 - 5% of the total area of the protected areas (corresponds to > 1,000 - 10,000 km2) **Note:** Protected areas damaged by the event (nature reserves, national parks, biosphere reserves, landscape protection areas, nature parks) and fauna (wild animals) are considered here.

Damage parameters: Damage to surface water/groundwater (U2)
Extent of damage classes: **A:** ◎ 0,01% **B:** > 0,01 - 0,1% **C:** > 0,1 - 1% **D:** > 1 - 10% **E:** > 10% **Note:** Here, surface waters damaged by the event (rivers, canals, streams, lakes, sea) and groundwater are considered.

Damage parameters: Damage to forest areas (U3)

Extent of damage classes: A:

≤ 0,01%

B: > 0,01 - 0,1%

C: > 0,1 - 1%

D: > 1 - 10%

E: > 10%

Damage parameters: damage to agricultural land (U4)

Extent of damage classes: A:

≤ 0,01%

B: > 0,01 - 0,1%

C: > 0,1 - 1%

D: > 1 - 10%

E: > 10%

Damage parameters: Damage to farm animals (U5)

Extent of damage classes:

A: 1,500 livestock units

B: > 1,500 - 15,000 livestock units

C: > 15.000 - 150.000 livestock units

D: > 150 000 - 1,5 million livestock units

E: > 1,5 million livestock units

Protected asset ECONOMY

Damage parameters: Impact on the public sector (V1)
Extent of damage classes: **A:** Costs incurred by the public authorities as a result of the event can be borne entirely by the affected country/countries, no direct consequences for the federal government. In individual cases, planned federal measures to support the affected region are being accelerated. **B:** Public costs caused by the event can be borne for the most part by the country or countries concerned. Reallocations within the budget can cover the funding needs. Some federal measures will be accelerated or brought forward. **C: The** costs incurred by the public authorities as a result of the event have a supra-regional scope. For the most part, they can no longer be borne by the country/countries concerned from their own resources. Reallocations in the budget cannot cover the need for funds; a supplementary budget must be adopted at state level. Due to the responsibility of the state as a whole, federal aid is necessary. **D: The** costs incurred by the public authorities as a result of the event are of such a large, supra-regional to nationwide scope that the Federal Government must make limited financial resources available in the short to medium term due to its overall state responsibility. Shifts in the budget cannot cover the need for funds; a supplementary budget must be adopted at federal level. The EU aid programme can be used. **E:** Very large impact. The costs incurred by the public authorities as a result of the event are so considerable, ranging from supra-regional to nationwide, that the Federal Government must make substantial financial resources available in the medium to long term due to its responsibility as a state. A supplementary budget must be adopted as a result of the event and the medium-term financial planning must also be significantly improved. This has implications for other areas of the federal budget. EU aid is needed (EU Solidarity Fund).

Damage parameters: Impact on the private economy (V2)

Extent of damage classes:

A: Costs incurred by the private sector as a result of the event can be almost entirely borne by the companies affected. There are no supra-regional impacts.

B: Costs incurred by the private sector as a result of the event can be largely borne by the companies concerned. There is little supra-regional impact.

C: Costs incurred by the private sector as a result of the event are of a supra-regional scale and some of the companies affected cannot bear them out of their own resources. Short- to medium-term revenue shortfalls are not expected for the affected industries or companies to expect. Some companies are going bankrupt, other companies are threatened with insolvency; in some sectors short-term supra-regional effects (supplier companies) can be observed.

D: The costs to the private sector caused by the event are of a large, supra-regional scale and many of the companies affected cannot bear them out of their own resources. In the medium to longer term, sales shortfalls are to be expected for the sectors or companies concerned. Numerous companies are going bankrupt, further companies are threatened with insolvency; in some sectors, medium-term supra-regional effects (supplier companies) can be observed. The Federal Government is called upon to promote reconstruction programmes. Recession looms.

E: The costs incurred by the private sector as a result of the event are of a considerable, supra-regional scale and a large proportion of the companies affected cannot bear them out of their own resources. Long-term loss of sales is to be expected for the industries or companies concerned. A large number of companies go bankrupt, many more companies are threatened with insolvency; in some sectors there are nationwide effects (supplier companies). The entire national economy is plunged into recession as a result of this event, and economic stimulus packages are necessary.

Damage parameters: Impact on private households (V3)

Extent of damage classes:

A: 4,000 +DXVKDOWH EHWURIIHQ

B: > 4,000 - 40,000 households affected

C: > 40,000 - 200,000 households affected

D: > 200,000 - 400,000 households affected

E: > 400,000 households affected

Note:

Definition of "affected": Households that are not able to cope with the restoration on their own.

PROTECTION GOODS IMMATERIAL

Damage parameters: Impact on public safety and order (I1)
Extent of damage classes: **A:** Maintaining public safety and order is easy. **B:** Maintenance of public safety and order is possible at regional level with slightly increased effort. **C:** Maintaining public safety and order at regional to supra-regional level is only possible with increased effort. **D:** Maintaining public safety and order is associated with great effort at supra-regional level or is regionally endangered. **E: The** maintenance of public safety and order is endangered on a supra-regional to national level.

Damage parameters: Political impact (I2)
Extent of damage classes: **A:** Policy implications at regional level. **B:** Political effects at supra-regional to state level. **C:** Political effects at state to federal level. **D:** Major political impact up to federal level. **E:** Very large political impact up to federal level.

Damage parameters: Psychological effects (I3)

Extent of damage classes: A:

◎ 100.000

B: > 100.000 - 1.000.000

C: > 1.000.000 - 10.000.000

D: > 10.000.000 - 40.000.000

E: > 40.000.000

Note:

The extent of the effects of the event on the perception/behaviour of the population is considered here, this includes changed work, social and consumer behaviour.

Damage parameters: Damage to cultural property (I4)

Extent of damage classes: A:

◎ 0,05%

B: > 0,05% - 0,1%

C: > 0,1% - 0,5%

D: > 0,5% - 1,0%

E: > 1,00%

Annex 3

Risk Analysis Civil Protection Federal Government

Extreme meltwater from the low mountain ranges

Status: 10.12.2012

Probability of occurrence:

ClassB: **unlikely**

an event which statistically occurs generally once in a period of 1,000 to 10,000 years

Extent of damage:

Schutzgut	Damage parameters		Extent of damage A		CD		E
HUMAN	M1	Dead					
	M2	Injured, Diseased					
	M3	People in need of					
	help						
ENVIRON	M4	Missing persons					
	U1	damage to protected areas					
	U2	Damage to surface waters/groundwater U3 Damage to					
	forest	areas					
	U4	Damage to agricultural land U5 damage to					
VOLKS-	farm	animals					
RTSCHA	V1	Impact on the public sector V2 Effects					
	on the	private economy V3 Impact					
IMMATERIAL	on private	households					
	I1	Impact on public safety and order I2 Political					
	implications						
	I3	Psychological effects					

SCENARIO

1. definition of the hazard/event type

According to Section 72 of the Federal Water Act, flooding is defined as "the temporary inundation of land not normally covered with water by surface waters or by seawater intruding into coastal areas". DIN 4049 describes floods as the "condition in an above-ground water body where the water level or flow has reached or exceeded a certain value (threshold value)". As a rule, these threshold values are important with regard to the damage potential inherent in a flood. This is determined by

- Vertex height, duration and discharge volume of the flood event,
- topography and use (accumulation of values) of the areas affected by flooding, and
- the season in which the event occurs. [1]

For the present scenario, the assumed flood threshold values are thus to be defined for each river section in order to provide, in conjunction with other parameters (e.g. flow velocity), the basis for an estimate of the expected extent of damage within the framework of the risk analysis.

A large number of different flood genesis and forms of occurrence are possible, depending on the different hydro-meteorological conditions prevailing in Germany and the neighbouring foreign river basins on the one hand and the hydrologically effective area characteristics on the other. River floods are part of the natural hydrological cycle and are caused in winter by several weeks of abundant continuous precipitation, often in combination with snowmelt and/or frozen ground, and in summer by a long period of wet weather, during which abundant shower-like (convective) precipitation events occur in combination with advective, large-scale precipitation in succession. Like all natural hazards, floods are initially natural events that become an imminent danger or actual catastrophe due to human settlement and diverse uses in the potential flooded areas. [2] For medium and large river basins

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[1] Cf. Engel 1997.

[2] While normal floods are valuable and necessary for the ecology, in the case of extreme flood events it must also be expected that relevant ecosystems will be permanently altered can be.

meteorological causes have a much higher significance in the occurrence of floods than changes in hydraulic discharge. [3]

2. description of the event

2.1 Location of occurrence/spatial extent

Where does the event happen?/Which area is affected by the event?
In the present scenario, floods occur simultaneously in the rivers Danube, Rhine, Ems, Weser, Elbe and Oder and their main tributaries. [4] Highly elevated water levels on wide stretches of these rivers lead to flooding of exposed areas along the river courses.

A map is attached to the scenario in the Annex, which shows for the underlying event which HQ peaks occur at the respective river sections. This was based on the highest HQ per river section occurring in the course of the event.

2.2 Timing

When does the event happen? (Season/occasional time of day)
The event takes place in late winter/spring (period: 01 January to 31 March).

2.3 Initiating events

What events lead to this event/What triggers the event? The flood was triggered by the onset of severe thaw in the catchment areas with a high proportion of low mountain ranges. In the ridges of the low mountain ranges, unusually high snow depths were accumulated during a long cold period with heavy precipitation, and even in the medium-high parts of the area, at the beginning of the dew period

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[3] Cf. Pohl and Dikau 2007.
[4] In the hydrological modelling of the underlying extreme hydro-meteorological event, smaller rivers (catchment area < ~2500 km²) were also simulated. For the determination of the too
However, only the major rivers and their most important tributaries are considered in the assessment of the expected extent of damage, since, on the one hand, the largest floods are expected in these areas due to the type of extreme scenario selected, i.e. the "snowmelt flood" genesis, and, on the other hand, the damage potential in the floodplains of these rivers only reaches dimensions that are relevant from the perspective of the federal government's overarching perspective.

nor a closed snow cover. Due to previous, short dew periods and the long lying time the snow cover is very rich in water (old snow, holds up to 4 l water/cm/m²).
In addition, a strong advance of warm air and high precipitation lead to an unusually rapid melting of the snow masses. Due to the high precipitation spring weather (north-west weather situation), the soils of the lower lying parts of the river basin are also saturated, so that there is an exceptionally high discharge near the surface over a large area, which is fed to the receiving waters without delay.

2.4 Intensity, duration and course

How strong is the event?
At most gauging stations along the affected rivers, floods occur with an annual frequency of one HQ200. In many cases the levels reach or exceed the HQExtreme mark. Due to the severity of the individual events, but also the overall situation, a situation of nationwide relevance is developing.

How long does the event and/or its direct effects last?
Increased levels occur over a period of a good two months.

What period of time after the beginning/occurrence of the event is to be taken into account when determining the extent of the damage?
Direct damage occurs during the event, so that a little more than two months are to be considered here. Cleaning up, repairs and the economic recovery of affected farms will take longer, but this is not taken into account in the risk analysis.

How does the event unfold?
Levels rise rapidly at the end of January and reach a peak for the first time after just under a week. Afterwards the levels drop again. However, they do not reach their normal values before they rise again. After reaching the second peak, the levels decline continuously until they return to their average level after a total of two months. The course described here in two tidal waves takes place on all affected rivers. There are differences in the characteristics: in some places the first wave is the larger, in some places the second. In other cases both waves have the same intensity.

The design flood, on which the flood protection facilities were based, is exceeded in many places. Dikes and sheet pile walls are flooded, furthermore

some dikes are damaged by the water masses overflowing them. Even in places where the water level does not exceed the height of the flood protection facilities, the exceptionally long duration of the event results in dike undermining, dike softening and other damage to structural flood protection measures, which in some places leads to the failure of these facilities. Flooding also occurs in those areas of the hinterland that would be protected during normal flood events. Against this background, the estimation of the maximum floodable space is made **without** taking these facilities into account. [5]

Figure 1 shows the course of the discharge for exemplary gauges:

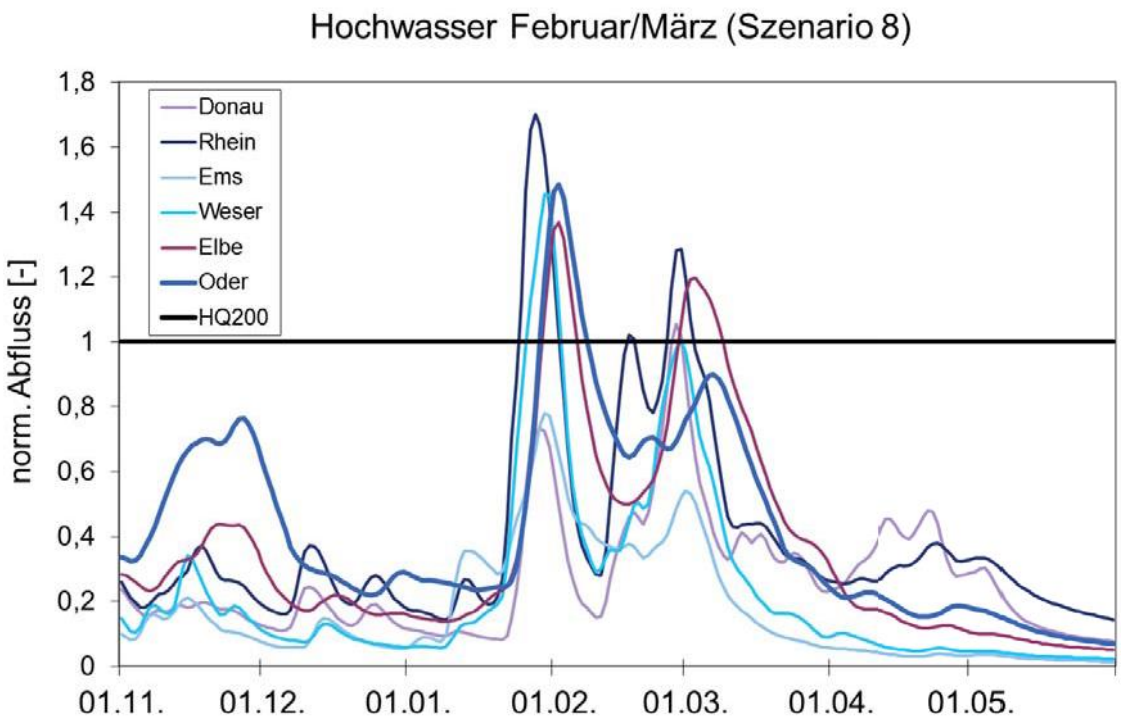

Figure 1: Daily values of the normalised discharge for the synthetic flood scenario at a representative level per river basin. [6]

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[5] As a study carried out by the BfG shows, the Czech dams had a significant relieving effect on the flood situation in Germany during the Elbe flood of 2002. Without the retention of these reservoirs, the record water level of 9.40 m measured in Dresden would have been 72 cm higher (cf. BfG (2012). The present scenario does not take into account the protective effect of dams, as this would not take into account certain uncertainties: for example, the actual retention capacity depends on the already existing water level at the dams, which cannot be predicted within the framework of the risk analysis, i.e. the scenario considers several other large rivers for which no studies are available on the retention effects of existing dams in the event of extreme events that actually occur.

[6] For standardisation, the ratio of the calculated discharge to the extreme flood peak value estimated for the respective gauge (HQ200) was formed. The HQ200 corresponds to a
Peak value which, based on an extreme value statistical analysis, is expected on average once in 200 years

In summary, it can be stated that this flood event is both exceptional and plausible with regard to the following characteristics:

- Peak values (HQ200 and HQExtreme)
- Duration (2 waves, ~ 2 months)
- spatial coverage (almost all river basins are affected).

2.5 Predictability/alerting/communication

Is the event expected?

The event can be predicted by weather forecasts in conjunction with hydrological forecasting systems. The first signs leading to the issuing of an early warning are ten days before the onset of the first wave. However, early warning is subject to relatively large uncertainties, so that this alone does not justify action. Three days before the rapid rise in levels, the forecasts are sufficiently accurate to allow concrete measures to be taken. However, an exact prediction of the expected level heights is not possible for all areas.

In the upper courses of rivers, especially in the smaller rivers and streams that flow into the main streams, the flood can start much earlier than at the gauges of the wider course of the river, which shortens the advance warning time. Due to the low temperatures, ice formation occurs sporadically. Washed away ice floes, ships and boats and other flotsam (logs, rubbish, etc.) not only pose a danger to buildings, bridges and flood protection facilities, but also form artificial dams at some narrow points where water accumulates. The breaking of these barriers releases large additional quantities of water within a very short time. In these cases, the advance warning time for the areas immediately downstream is very short. This makes it difficult to make accurate forecasts for the areas concerned. However, overflights and observations of the banks of the river make it clear in advance where barriers are forming, so that this danger can be taken into account in the planning and implementation of protection and evacuation measures.

The onset of the second flood wave, like that of the first wave, is predicted with a three-day advance warning period.

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will. The standardization allows a direct classification of the synthetic flood scenario with regard to the extreme behaviour and a comparability of the results between the river basins.

The flood information services of the Länder7 evaluate the available hydrological and meteorological data, issue flood warnings and provide information as required (situation reports, maps, etc.). Figure 2 illustrates the procedure:

Figure 2: Schematic representation of the flood reporting and warning service (Source: HAD, 2003).

To what extent can the authorities prepare for the event?

In principle, the authorities can prepare for the event on the basis of the existing warning and alarm plans. However, uncertainties in the forecasting process occasionally lead to misinterpretations and misactions by forecasting services and decision makers. In general, official action is also dependent on corresponding experience with flood events.

[7] Cf: Cross-border flood portal, a joint initiative of the German federal states http://www.hochwasserzentralen.de/

Can the population prepare for the event?

The scenario is based on the assumption that the information of the population is timely, adequate and consistent. Special instructions and instructions for action are communicated via various media (television, radio, Internet, press), if necessary in an acute case also via announcements by the emergency services. The order of evacuation is also communicated in good time where necessary, reaching the majority of the population.

Thanks to early warning and continuous communication of the forecasts, the majority of the population can prepare for the event. Especially in the areas close to rivers, many residents are sensitized by personal experiences with flood events, in connection with the long-lasting, high precipitation overall weather situation, the reports of snowmelt and the general weather forecasts and flood warnings. Where, in the course of prevention, successful risk communication has already taken place in advance (information on general flood hazards, recommendations for action, e.g. through residents' meetings or official brochures), the information is quickly absorbed and correctly processed. Where this has not been done in recent years, warnings and instructions for action must be communicated with particular emphasis.

Overall, however, the official warnings do not reach the entire population, so that not all persons concerned are equally well informed and sensitized in advance. Socio-cultural and demographic aspects also play an important role (e.g. language skills, cultural background). It should be noted that the sensitisation, the perception of personal danger and one's own preparation for coping with a possible flood event decrease with increasing residential distance from the river courses.

2.6 Official measures

Building on existing flood risk management plans, alarm and emergency plans and past experience, local authorities in the affected areas take timely measures to prevent or reduce flood-related damage to people, animals, the environment and property. This also includes informing the public about preventive flood protection and warning in the event of a hazard. Initial measures include the closing of dyke gates, the erection of mobile sheet piling and other flood protection measures (e.g. construction of jetties, closing of roads, preparation of sandbags).

With rising water levels and expected prolonged high water levels, the securing of the dikes is of particular importance, which makes it necessary to increase the efforts of the local fire brigades, the German Federal Agency for Technical Relief (THW) and other forces (e.g. volunteers). Crisis and management teams are convened at an early stage and take over the management and coordination of all measures. In endangered areas (e.g. where there is no structural flood protection) evacuation measures are ordered, the implementation of which is the responsibility of the police, fire brigade and aid organisations. As soon as it can be foreseen that the safety of the dikes and dams can no longer be guaranteed across the whole area due to undermining, soaking and the physical loads, or as soon as other circumstances justify the decision, disaster alerts are triggered in the affected areas. Increasingly, emergency forces and material (especially sandbags) are requested from neighbouring communities and districts that are not affected.

Due to the rapidly deteriorating situation, evacuations will be extended as the event progresses. Persons who try to evade evacuation, who are helpless or who have not been reached by the official orders are brought to safety by the police. Where self-sufficiency is no longer possible in lightly or partially flooded residential areas, the supply of the affected persons is ensured by auxiliary staff. By way of administrative assistance, the Federal Police, other THW forces and the Bundeswehr are requested to provide support in particularly badly affected areas. Air transport means are also used to transport personnel, equipment and relief supplies to areas of operation or to support rescue operations. Crisis teams at country level help to coordinate operations. The Joint Reporting and Situation Centre (GMLZ) of the Federal Government and the Länder provides situation pictures and arranges bottleneck resources on request of the Länder. After only a few days, emergency forces from all over Germany are permanently on duty. With the increasing flooding of existing dikes and dams, protection and safety measures are necessary in the hinterland, which has not been affected so far. In addition, a focus is placed on the protection and safeguarding of critical infrastructure facilities in the affected areas. In order to relieve the German units and to ensure a sufficient supply of material (especially sandbags), forces from other (EU) states are requested via bilateral assistance agreements and via the Monitoring and Information Centre (MIC), within the framework of the EU Community Mechanism for Civil Protection. The involvement of foreign forces at the local level takes place at an early stage, within the framework of bilateral agreements.

3. effects on CRITIS/supply

Preliminary remark:

The critical infrastructures listed below are complex systems on which a large number of supply functions depend. In principle, it can be assumed that the impairment of individual infrastructure sectors and industries will also have an impact on other infrastructures and their supply services. [8] This circumstance cannot be illustrated here in its complexity. Since the risk analysis is carried out from the overarching perspective of the Confederation, the expected effects on the area of CRITIS/provision are presented below in a generalised, qualitative manner. Significant interrelationships are discussed in the explanations of the individual sectors. [9]

The basic assumption for the flood event described in this scenario is that the population of the areas particularly affected by the flooding, in which a failure of supply is also to be assumed, is evacuated. Consequently, it is not necessary to maintain supplies within these areas.

ENERGY sector

	Industry	Explanations
X	Electricity	In the immediate flood area, electricity is switched off for safety reasons or fails due to disturbances in the local distribution network. In the vicinity of the flooded areas, the power supply fails at the distribution network level; continued operation of the transmission networks is still possible. People who are not evacuated are affected by temporary restrictions on electricity supply. Hydroelectric power plants are shut down and thus no longer supply electricity. Nuclear, coal, gas, oil and biomass power plants are often located near large rivers to facilitate the supply of cooling water. Here it comes by penetrating water sporadically to impairments in power generation. Power plants that are in regular operation

[8] With regard to the danger of "flooding", the failure of IT/telecommunications systems, for example, can make it difficult/delayed to remedy faults in other areas and can also have an impact on the crisis management of the authorities. Impairment of transport and traffic infrastructures can impede the accessibility of further supply facilities for personnel and suppliers and require alternative solutions.

[9] This is based on well-founded assumptions and expert assessments. For quantitative statements additional, more in-depth analyses would be necessary, which would also have to take into account the complexity of the variously interwoven infrastructures. Correspondingly detailed background information is not available at federal level for many areas of responsibility.

		are supplied with fuels via rivers, often cannot be supplied sufficiently via land routes. As inland navigation has to be stopped during floods, the supply of coal-fired power stations, for example, is interrupted. Shore-side supply and recourse to the power plant's own bunker reserves cannot compensate for this interruption over the full period of the event. If electricity bottlenecks become apparent in the interconnected grid, they can be partly compensated by increasing the feed-in from other, unaffected power plants and via the Europe-wide interconnected grid. In addition, network operators can take regulatory measures that have a stabilizing effect on the overall network (e.g. power could be switched off for a few hours in each region). **Against this backdrop, long-lasting, large-scale power outages are not expected.** [10] Combined heat and power plants are also affected, so that district heating networks are likely to fail.
X	Gas	Gas pipelines continue to function, only in the immediately flooded area the local distribution networks are shut down for safety reasons. Locally, there is damage to the gas supply (damage/destruction of the network, distribution stations and connections due to flushing of underground pipes, water ingress via unsecured house connections, direct water impact on pipes attached to bridges, etc.), which in some cases have to be repaired at great expense once the flood has subsided. People who are not evacuated, are affected by temporary restrictions on gas supply.
X	Mineral oil	Oil (derivatives) pipelines continue to function. The supply of crude oil (derivatives) via inland waterways is disrupted. The same applies to road- and rail-bound supply, since roads near the banks are flooded. Since the supply of emergency forces and power plants, there is a tendency for petrol stations to be

[10] In addition to the risk of a power failure due to the failure of infrastructure components, flooding could also pose a threat to the population from individual power supply infrastructures. In particular, the hazard posed by nuclear power plants in the flood area would have to be investigated in this context. This has been done in the context of the EU stress testing and safety review of the Reactor Safety Commission, which were carried out after the Fukushima incident. It was determined that all nuclear power plants in Germany would be able to withstand floods with a return interval of at least 10,000 years. Thus, accidents are not to be feared in case of a 200-year flood event in nuclear power plants in Germany (cf. on this: EU Stress Test - National Report of Germany, BMU 2011), Plant-specific Safety Review (RSK-SÜ) of German nuclear power plants under consideration of the events in Fukushima-I (Japan), Reactor Safety Commission 2011, critical on this: Statement on the "Stress Test" of the Reactor Safety Commission of 17.05.2011, Office for Nuclear Safety 2011, Assessment of the plant-specific safety review (RSK-SÜ) of German nuclear power plants by the Reactor Safety Commission (RSK) of 16 May 2011, Greenpeace 2011)

		bottlenecks, but not across the board. Should major bottlenecks occur due to the failure of important refineries, there is the possibility of drawing on strategic reserves due to the special exceptional situation, which would ...would ensure the supply of electricity again.

Information and Telecommunications sector

	Industry	Explanations
X	Telecommunications	In the immediately flooded areas there may be problems with the wired telephone network due to local power cuts or the direct ingress of water into infrastructure components. In areas where the wired telephone network is still functioning but where there is no longer a power supply, telephone communication is also disrupted (often ISDN connections, charging stations for cordless telephones, VoIP, etc.) In addition, some base stations of the mobile phone network fail as a result of flood-related local power cuts. Due to the failures, there is no mobile phone coverage in some areas of the flooded areas or the power outage. At the same time, heavy use of mobile networks in the affected areas is to be expected. It can be assumed that the telecommunications service providers have not set up vital, non-redundant facilities in the flood area, the failure of which could affect the entire system. As a result, there are only isolated failures.
X	Information Technology	See Telecommunications

TRANSPORT AND TRANSPORT SECTOR11

	Industry	Explanations
X	Aviation	Of the international and regional airports in Germany, Frankfurt a.M. and Düsseldorf are partly in the flood area. Bremen Airport is located completely in the flood area. Of the regional airports, Karlsruhe/Baden-Baden is affected. Against this background, restrictions are to be expected, but from a federal perspective no serious effects on air traffic are to be expected.

11 It can be assumed that the flood event described in the scenario will have serious impacts on the entire "transport and traffic" sector, especially where inland waterways, rail and road transport fail simultaneously.

		Fuel supply to airports is largely via pipelines; serious restrictions on air traffic due to fuel shortages are not expected. However, effects can result from the fact that people and/or freight can no longer reach or leave airports via land-based transport routes or only under difficult conditions.
X	Maritime navigation	Maritime transport is affected to the extent that goods are not delivered to can be delivered to or removed from seaports
X	Inland navigation	Commercial inland waterway transport will be discontinued on all the rivers concerned. Ships are moored at the berths and ports. Damage to port facilities, traffic water management structures and ships is to be expected. As a result, some ships and parts of port facilities fail even after flooding. Impairments to the transport infrastructure in the hinterland also have an indirect effect on inland waterway transport. For example, in some large inland ports goods can no longer be transported on a regular basis. In addition to its importance for the energy and food industries, inland navigation is also very important for logistics and other areas, so that considerable effects can be expected here.
X	Rail transport	Railway lines in the flooded area are impassable because they are flooded or threatened by undermining. This leads to the cancellation of a large number of rail connections and poses immense challenges for the overall scheduling, especially since some of the losses in inland waterway transport must also be compensated for by rail. In general, the scheduling of freight flows by rail is more complicated than by road. The Rhine axis is of particular importance. Since rail transport along the Rhine is at a standstill and a shift to alternative routes is not possible or only possible to a limited extent, the north-south transport of goods and passengers is only possible by road. In particular, the loss of transhipment stations for combined (partly trimodal) transport leads to considerable effects on the logistics and freight transport sectors.
X	Road traffic	Roads in the flooded area are impassable, as are some tunnels under the rivers. Numerous federal motorways, country and district roads are also affected in places. A considerable additional volume of traffic is expected on alternative routes, especially as these also parts of the failures in rail transport (cf. the Rhine axis problem) and

		in inland waterway transport. In addition to the increase in general car and truck traffic, there is also an increase in Hazardous goods and heavy goods traffic.
X	Logistics	Logistics centres (which serve both as depots for lorries and, more specifically, as transhipment points for goods) in the flood area (e.g. at inland ports) are no longer needed. Trucks and goods can be evacuated to alternative areas. The problems in shipping, road and rail transport have a direct impact on logistics companies and the transport of goods. Scheduling freight transport by road is becoming increasingly difficult, as demand for trucks is high and delays due to traffic jams are likely to be considerable. At the same time, however, it must be assumed that the volume of goods will not reach the usual level due to the loss of production facilities and businesses in the flooded area. The impact of delays and Failures are nevertheless noticeable in a wide variety of areas.

HEALTH sector

	Industry	**Explanations**
X	Medical care	In the flood plains, which also include some conurbations, hospitals, doctors' surgeries, old people's homes, etc. must be evacuated or cease to operate. At the same time, people who were previously cared for or looked after at home must be evacuated. Hospitals and nursing homes in non-affected areas can accommodate the patients and residents to be evacuated. Where necessary, patients whose hospital stay can be shortened can be discharged, and non-essential operations can be postponed. If specialised hospitals or departments of supra-regional importance are no longer available (e.g. those for the treatment of severely burned patients), an attempt is made to create approximately equivalent alternative possibilities in the nearest, unaffected areas by relocating material and skilled personnel. An additional burden on the health system due to outbreaks of epidemics is not expected. In particular, the occurrence of diseases due to decomposing animal carcasses is almost impossible, since a particularly high number of carcasses is not assumed, only a few pathogens are considered at all, the temperatures are low and the Keep people away from the carcasses.
X	Drugs and vaccines	Pharmaceutical production facilities located in the flood area must cease operations. Does this also apply to establishments which have a Key function in the production of certain drugs and/or

		If you take the basic steps in this respect, it may not be possible to obtain a substitute from other manufacturers at home or abroad. Pharmacies have only limited stocks, so that even here in the affected regions temporary supply shortages are to be expected.
X	Laboratories	Cf. "pharmaceuticals". Some laboratories in the flooded areas will have to cease their services. Depending on the laboratory's field of activity, this may result in additional hazards for the population and the environment.

WATER sector

	Industry	Explanations
X	Public water supply	For the following reasons, piped drinking water supply is locally impaired in the flooded areas and in some cases beyond, and sometimes even has to be stopped12 : - The input of pollutants remobilised or released by the flooding of factories, operations, workshops, but also of pathogens (e.g. from sewage disposal plants) into water protection areas leads to impairment of raw water quality. This causes problems in the treatment process. This can be expected especially for water supply systems that are fed from surface water. Supply areas that are fed from groundwater are less affected here. - Besides failures due to water hygiene problems, infrastructure components of the drinking water supply fail (either due to water ingress, secondary effects such as power failure or inaccessibility or physical damage to parts of the pipeline network). Where the mains water supply fails, part of the water demand (drinking water, process water, flushing water) can be covered by a pipeline-free supply (e.g. by THW).
X	Public sewage disposal	Flooding of the sewer system, which causes overflowing of the pipes, as well as the failure or flooding of sewage treatment plants allow large quantities of untreated sewage to escape into the environment. People who come into contact with this water can fall ill.

[12] In the case of the Elbe/Danube floods, the grid-bound replacement supply was at the limits of its capacity, cf. Wricke 2003.

		Due to damage or blockage of sewage pipes, sewage disposal cannot be maintained everywhere. Where the drinking water supply has to be cut off, the transport of wastewater is also affected. In particular, the transport of faeces from domestic wastewater is a serious problem when the drinking water supply is interrupted. In the sewer system itself, the large proportion of extraneous water (which can account for half of the planned wastewater share) means that wastewater transport can still be guaranteed, if necessary The failure of some pumping and lifting stations (due to Overload/damage or power failure) leads to the fact that in sections the removal of the waste water fails.

FOOD sector

	Industry	Explanations
X	food industry	In the area of food production there is a particularly strong dependence on the availability of transport and communication services. Production facilities in the flooded area have to stop their work. This also affects some large mills. This gives logistics a special significance. Since just-in-time production is also widely used in the food and feed industry, it is particularly dependent on a functioning transport network. Especially the transport of perishable food for sale or for further processing, but also the transport of food with a longer shelf life is precisely timed, often involving long distances. If it becomes apparent that the interruptions in the operating process are too great, transport prioritisation may have to be carried out. The event had a noticeable impact on the supply of the population with individual products. 30% of the grain milling capacity is affected by the floods. [13] From the third week onwards, supply bottlenecks for flour and thus also for baked goods and pasta are to be expected throughout Germany. Particularly east of the Elbe, the problems are rapidly increasing and here, from week 5, less than 50% of the usual amount of products made from flour is available. Nevertheless, the nationwide supply of food is largely secured.

[13] Seed processing companies, such as mills and compound feed companies, generally hold stocks of raw materials of European origin for two to four weeks and four to eight weeks in the case of overseas origin.

		After 3 weeks there are considerable restrictions in the provision of feed. The most important oil mills are located in the flood area, and when the processing of oilseeds is stopped, the supply of protein carriers to the compound feed mills collapses. Since many of the large compound feed plants are located on waterways and purchase imported goods via inland waterway vessels, these too will no longer be able to supply complete feed. Livestock farmers in north-west Germany will be the hardest hit, as this is where the largest livestock stocks are located and the supplying feed factories. This will have an impact on milk, meat and egg production and, in addition to a significant reduction in supply to consumers, will have lasting, negative economic consequences for the entire economic sector. As meat processing plants are hardly affected by the flooding, it could be handicapped distribution channels to store meat.
X	Food Retailing	In the food retail sector, there is a particularly strong dependence on the availability of transport and communication services. The food trade in the evacuation area is stopped. With such a long period of events, it is to be expected that the retail chains themselves will set up some alternative bases. In some places, central offices for emergency care must be set up, and in some cases, emergency services must provide care for people directly in their homes. The effects of the flood are also felt in the rest of the flood area, as the distribution of finished products to wholesalers and food retailers faces the same challenges as the transport of primary products. As there are no concrete statements on the obstacles in transport, the impact on the food trade cannot be estimated.

FINANCIAL AND INSURANCE sector

	Industry	Explanations
X	Banks	The banks in the flooded area are closing or are difficult to reach. Emergency measures taken by the banks are likely to include only the orderly shutdown of the site and the backup of data, as no alternative sites can be set up for banks. However, unaffected banks in the adjacent area can be increased in staff. To There are no effects on the nationwide banking system.
X	Stock exchanges	The stock exchanges continue their operations without restrictions.
X	Insurance	Insurance companies only face challenges after the event

		(financial), only in the flood plains must branches will be closed.
X	Financial service provider	Financial service providers continue to operate, only in the flood plains, branches have to be closed.

Sector STATE AND ADMINISTRATION

	Industry	Explanations
X	Government and administration	Government institutions and administrative authorities in the flood area have to move into emergency accommodation, as the power supply, and in many cases immediate accessibility, cannot be guaranteed. Since the majority of the files are not moved, but only secured more complex, non-urgent processes are at rest.
X	Parliament	Bundestag and state parliaments continue to work without restrictions, if necessary in alternative quarters.
X	Judicial institutions	Judicial institutions continue to function like government and administration. Prisons located in the flood area are evacuated. Where distribution to other prisons is not possible, but the facility can be effectively protected against flooding, the facility continues to operate.
X	Emergency/rescue services including Civil Protection	Police, fire brigade, THW, disaster control and rescue services are constantly on duty. Since local forces are not sufficient to carry out flood protection measures, evacuations, relocation trips, supply tasks, etc., units are being relocated from all over Germany to the affected areas. Especially the evacuation of affected hospitals, old people's homes and other facilities ties up patient transport capacities in the first few days (advance warning time: 2 - 3 days), since even more distant destinations must be reached. The need is so great that only a minimum of personnel, vehicles and equipment will remain in the areas not affected. The basic supply remains guaranteed everywhere. In individual cases, the auxiliary deadlines are exceeded. The only major restrictions would be in the management of major emergencies. Units of the Bundeswehr are deployed in a supporting role, but on a large scale. Flooded buildings, equipment in these buildings and technical facilities in the flooded area, such as converters for BOS radio, are not available. Helpers who are deployed in the flood area expose themselves to a certain degree of danger from contaminated water. The appropriate protective measures are taken against this. Nevertheless, some helpers fall ill.

Sector MEDIA AND CULTURE

	Industry	Explanations
X	Radio (television and radio), printed and electronic press	There are no significant restrictions in the media sector. Establishments in the flooded area have to cease operations, but the supply of media services to the majority of the population is maintained. In the flooded areas that did not have to be evacuated, television, Internet and radio are unlikely to be available nationwide, mainly due to the failure of power-dependent terminals. The delivery of newspapers will also not be can be achieved everywhere.
X	symbolic Buildings	Symbolic buildings in the flood area can be massive and be permanently damaged or destroyed.

4. objects of protection concerned

Which objects of protection are directly or indirectly affected by the event?

Note: At this point it is generally recorded for which objects of protection impacts/damage are to be expected from the event and from the failure of critical infrastructures. The actual extent of damage is determined in a separate step of the risk analysis.

Effects on the protected good HUMAN:

Dead (M1):

Deaths are to be expected. If adequate evacuations are carried out, a significantly lower number of deaths can be expected than in the case of inadequate evacuation or sudden breaches of dike or similar. People die, for example, during attempted rescue operations or when trying to retrieve objects from cellars.

Injured / sick (M2)[14]:

Injuries are to be expected. If adequate evacuations take place, a significantly lower number of injured is to be expected than in the case of inadequate evacuation or sudden breaches of the dyke or similar. It is possible that diseases occur in connection with water hygiene aspects and possible consequences.

People in need of help (M3):

A large number of people in need of assistance can be expected to require care (e.g. due to evacuation of communities along a river), often over a long period of time. It can be assumed that emergency shelters must be set up and maintained. Evacuations of hospitals, retirement homes, etc. must also be taken into account here.

Impairments to water hygiene can also lead to a need for assistance.

Missing (M4):

Missing persons are to be expected in the short term.

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[14] The floods will flood and partially damage sewage treatment plants and urban drainage systems, as well as farms, fattening farms and slurry tanks. As a result, human and animal excreta enter the environment untreated and in large quantities. It contains microorganisms and viruses that can be dangerous to humans to varying degrees, depending on their physical condition (previous illnesses, injuries). Examples of pathogens that can potentially cause serious diseases are Escherichia coli and Salmonella. Staying near facilities that can release microorganisms should therefore be avoided, and emergency services must work with appropriate caution. Due to the high dilution effect of the water masses and the low water temperature, the concentration of the pathogens and thus the risk of disease decreases significantly with increasing distance from the source of the release. It is also possible to reduce the number of pathogens even before flooding by improvised disinfection (e.g. by adding chlorine or lime). The carcasses of dead animals can also be dangerous to human health, although the risk in Germany is much lower than in other countries or climate zones - many pathogens do not usually occur in Germany. Here, too, the dilution effect and the low temperatures have a positive effect, so that an immediate risk of infection basically only exists in the vicinity of the carcasses - but the population instinctively avoids this proximity. Nevertheless, the disposal of the carcasses must begin as soon as possible.

If water areas from which the drinking water supply is fed are located at a short distance from the pathogen sources and downstream of them, it must be checked whether the drinking water obtained is harmless to health. In many places the drinking water supply must be restricted. Where drinking water is extracted from groundwater, the filtration effect of the soil layers is usually sufficient to ensure the safety of the water, but here too, investigations are necessary. During the Elbe/Danube floods in 2002, no increased disease rates were registered among the people affected, but a clear contamination of some cellars with multi-resistant bacteria was conspicuous. This shows how effective and at the same time necessary it is to comply with hygiene and precautionary measures.

Effects on the ENVIRONMENT15:

damage to protected areas (U1):

Soil erosion, uprooting of vegetation, flooding, siltation and pollutant inputs are to be expected. Near-natural floodplain landscapes are best able to compensate for the damaging effects of flooding.

Damage to surface water/ground water (U2):

Pollutant input into surface waters and groundwater is possible (e.g. from fuel oil tanks, storage facilities, remobilised contaminated sediments)

Damage to forest areas (U3):

Soil erosion, uprooting of vegetation, flooding, siltation and pollution may occur.

damage to agricultural land (U4):

Damage to agricultural land through soil erosion, uprooting of vegetation, flooding, siltation and pollutant inputs must be expected.

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[15] It is to be expected that the flood event assumed here will release pollutants in not inconsiderable quantities and that they will be released into the environment (water, soil, flora and fauna) (see UFZ - Umweltforschungszentrum Leipzig-Halle GmbH, Schadstoffbelastung nach dem Elbe- Hochwasser 2002, Magdeburg 2005). This can have various causes, e.g. due to insufficiently secured chemical plants in the flood area, but also (and this with a very high probability) due to the flooding of private property and other businesses that cannot primarily be assigned to the chemical industry, since hazardous substances are also stored here (paints, varnishes, thinners, solvents, adhesives, synthetic resins, fertilisers, pesticides, motor vehicle fuels, fuel, batteries, etc.). During the Elbe/Danube floods of 2002, the floating and leaking heating oil tanks in particular were a burden on the environment. In addition, the re-mobilization of pollutants from already sedimented sediments and contaminated soils is to be expected. The substances not only pose a threat to the environment, but also to people staying in the area or returning to the area after flooding. After the Elbe and Danube floods, buildings whose masonry was permeated with pollutants had to be demolished several times. Radioactive substances could also pose a certain risk potential, albeit to a limited extent. They are not only used in nuclear power plants, but also in radiation medicine facilities, disinfection plants for food, medical equipment and blood, research facilities, etc., so that the safety of the substances must be guaranteed throughout the entire event - also and in particular when the surrounding infrastructure is destroyed. If floods were to cause large quantities of particularly dangerous pollutants to escape from industrial installations, this would result in potentially catastrophic consequential damage and considerable additional problems in managing the general flood situation (need for additional evacuations, high risk for remaining or downstream emergency services). This would require separate risk analyses based on appropriate scenarios (combined events).

damage to farm animals (U5):
In some cases, farm animals can be harmed.

Impacts on the ECONOMY as a protected good:

Public sector (V1):
Damage to buildings in the flood area (especially in cellars and lower floors) and to infrastructure (e.g. bridges) is to be expected. Especially the reconstruction of state-owned facilities (rail network, roads, bridges, buildings) and reconstruction aid for private individuals (cf. total damage caused by the Elbe/Danube floods in 2002: approx. 11.4 billion €) will result in considerable costs for the public sector. Tax shortfalls due to significant production losses are to be expected. In addition, costs for the repair of protective structures (e.g. dikes) and installations for inland navigation (e.g. locks, pumping stations) are to be expected. In addition, there are also costs for the deployment, the funds used and the loss of working hours of the volunteers.

Private economy ($_{V2}$):
Damage to operational sites in the flood area is to be expected (storage sites, inland ports, etc.). Corresponding losses in economic output due to the flooding of businesses, production facilities and industrial sites are also to be expected. In addition, fewer tourists are expected in the affected areas for some time. Insolvencies and dismissals are possible.

Private households (V3):
Damage to residential buildings in the flood area is to be expected (especially in cellars and lower floors). It can be assumed that a large number of private households will be affected, some of which will not be able to bear the costs of reconstruction themselves.

Effects on the object of protection IMMATERIAL:

Public safety and order (I1):
Effects on public safety and order are to be expected. Example: Police forces have to set up/guard barriers and maintain a minimum presence in evacuated areas in order to reduce the number of possible break-ins or to be able to intervene quickly if disorientated persons are in danger.

Political impact (I2):
Throughout the entire situation, a high level of national and international public interest, both in the incident/damage and in crisis management, can be expected. The responsible politicians and authority employees would be expected to act quickly and effectively and to communicate openly and transparently. It is also conceivable that the question may arise as to whether better preparation would have been possible, also with regard to better land management in the river regions (retention areas, etc.). Whether there will be demands for resignation will depend in particular on the crisis management and crisis communication of those responsible in politics and administration.

Psychological effects (I3):
It can be assumed that actual and potential involvement has different consequences for the behaviour of the population. Furthermore, it can be assumed that a - not yet existing - extreme event has different psychological effects than regular/known flood events. If necessary, considerable psychological effects can be expected (long-term effects). Here, the fundamental problem of a lack of awareness of danger/risk among the population ("fully comprehensive insurance mentality") is likely to play a role. The peak of the psychological effects is more likely to occur in the final phase of the event than during its genesis.

damage to cultural property (I4):
Damage to cultural property that cannot be evacuated is to be expected.

5. reference events

The water level system in Germany has existed for about 200 years. For this period of time, the flood events that occurred can therefore be quantified, at least for the larger rivers in Germany, and, together with meteorological observation series, can also be interpreted with regard to the different flood genesis. Since floods have always been associated with enormous damage, there are numerous written records and water level marks from the pre-instrumental period that allow us to identify flood events.
T. to the year 1000 AD. All this information indicates that of the various flood genesis, such as convective rain, prolonged rain, ice accumulation and snowmelt, the latter has the greatest potential to affect several river basins simultaneously.

From pre-industrial times, the floods of February/March 1595 and 1655, February-April 1709, February/March 1784 and 1799 should be mentioned here. Of these events, almost all were

River basins of the Danube, Rhine, Elbe and Oder are affected, although the Weser was not represented in this analysis.

From the time period of the instrument measurements, the flood events of March 1845, 1876, 1947, 1956, 1970, 1988, 2001, 2006 as well as January/February 1995 and December/January 2011 could be assigned to the flood genesis of snow melt in combination with long-lasting precipitation. Of these events, the flood of 1845 is of great significance, as floods with an annuality of 200 years (HQ200) were reached or exceeded in the Main, Weser and Elbe areas. This HW event can be assigned an HQ50 or greater in the Rhine basin, and thus reaches the magnitude of the floods of 1993 and 1995, including the winters of 1978/79 and 2010/11, which are not characterized by extreme floods, but which stand out from the other winters due to a particularly high snow cover build-up in Germany. Another extreme snow winter of 1998/99 in the Alpine region led to extreme flooding in the Danube and Upper Rhine areas in May 1999, while the snowy winter of 2005/2006 caused a major event and corresponding damage, particularly in the Elbe region. In the lower reaches of the Elbe almost HQ50 was reached. This event is therefore one of the largest floods of the last century in this section of the Elbe.

The so-called ice floods also represent a particular risk potential. It is known from the pre-instrumental period that this type of flood can also occur in river basins located in the western parts of Germany. After a long period without such floods, the severe winter of 1996/97 caused such an event in the Moselle region. The Oder region was also at risk of ice flooding in January 2011. The force that the Ice-Oder can develop was observed at the Lower Oder Valley National Park, where the dike tops were literally "shaved off" in two sections over a total of 200 metres. There are also reports of dyke peeling by ice on the Elbe during the floods in January 2003.

Extreme flood events can also occur in summer. The potential to affect several river basins can be attributed to the meteorological event "low pressure area on the Vb railway line". The so-called Magdalenen Flood of July 1342, which affected large parts of the Danube, Elbe and Weser areas, must be regarded as an extraordinary extreme from pre-instrumental times. Water level marks and discharge reconstructions indicate that HQ200 has occurred in many sections of the river, and in many places HQ extremes. The floods of July 1997 (Oder), August 2002 (Danube and Elbe), August 2005 (Danube and Upper Rhine), August 2010 (Spree and Neisse) can also be attributed to this recent flood genesis. In addition, in coastal areas, inland floods and storm surges from the sea can also overlap (such a case occurred in the Elbe on 04-05 February 2011), so that water levels

above the Geesthacht barrage are also increased due to storm surges.

The listed historical and recent flood events that have occurred in Germany form the background and starting point for the preparation of the present flood scenario.

Numerous reports on the estimation of damage caused by flood events are already available from pre-industrial times. Especially since the Rhine flood of 1993, there have been increasing estimates of the extent of damage caused by floods under the boundary conditions prevailing today.

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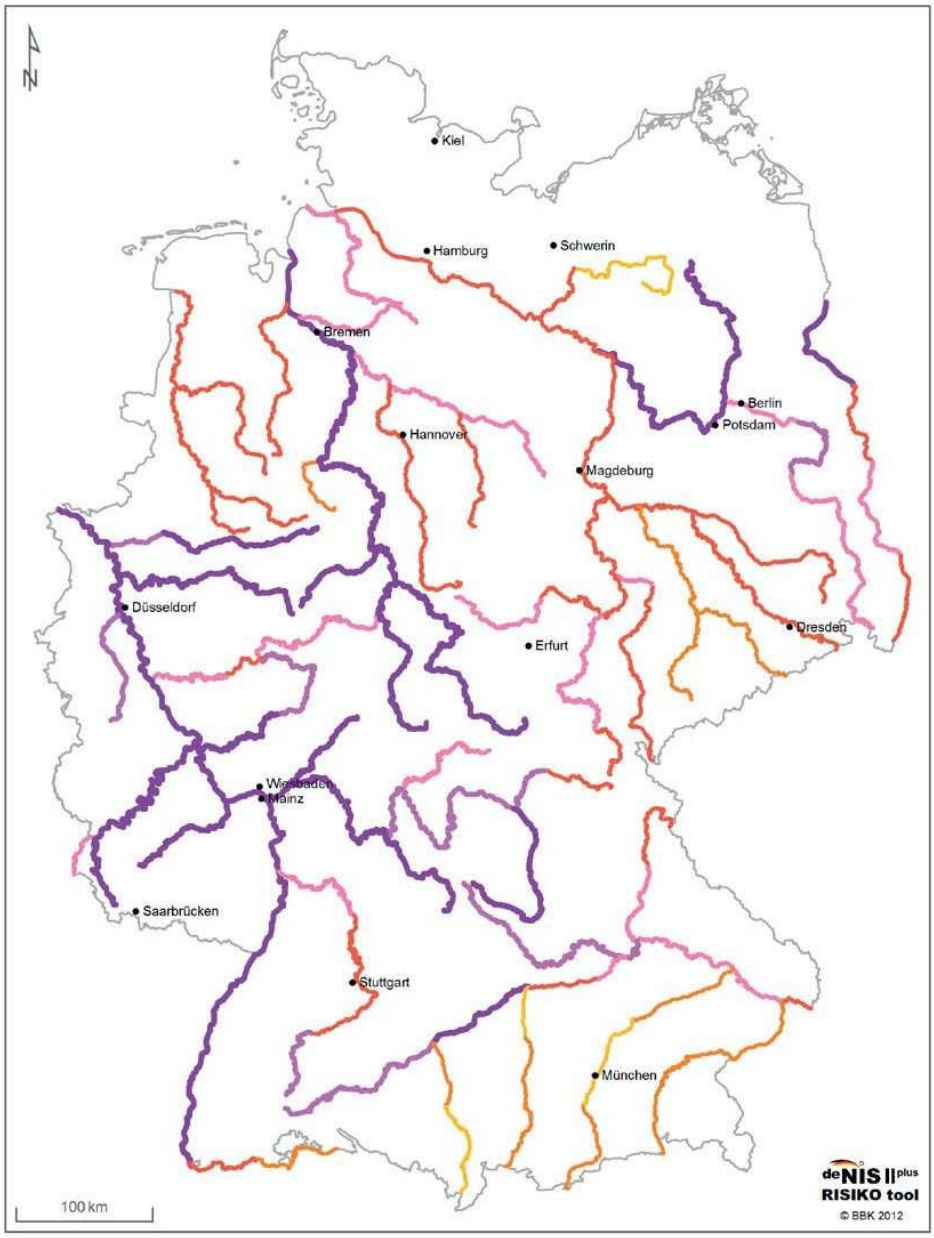
Szenario: Extremes Schmelzhochwasser aus den Mittelgebirgen



Klassen der HQ-Scheitelwerte:

- bis HQ 2
- bis HQ 10
- bis HQ 50
- bis HQ 100
- bis HQ 200
- > HQ 200

Datenbasis:

Hydrologische Daten: Bundesanstalt für Gewässerkunde (2012)

Hydrologischer Atlas von Deutschland (2003)

© GeoBasis-DE / BKG (2009)

Annex 4

Risk Analysis Civil Protection Federal Government

Pandemic caused by virus "*Modi-SARS*"

Status: 10.12.2012

Probability of occurrence:

ClassC: **conditional probable**

an event which statistically occurs generally once in a period of 100 to 1,000 years

Extent of damage:

Schutzgut	Damage parameters	Extent of damage A		CD		E
HUMAN	M1 Dead					
	M2 Injured, sick M3					
	Needed assistance					
	M4 Missing persons					
ENVIRO	U1 Damage to protected areas					
	U2 Damage to surface water/ground water U3 Damage to					
	forest areas					
	U4 damage to agricultural land U5 damage to					
	livestock					
VOLKS-RTSCHA	V1 Impact on the public sector V2 Effects					
	on the private economy V3 Impact					
	on private households					
IMMATERIAL	I1 Impact on public safety and order I2 Political					
	implications					
	I3 Psychological effects					
	I4 damage to cultural property					

SCENARIO

1. definition of the hazard/event type

A pandemic is a worldwide spread of a disease.

Exceptional epidemics may have natural causes, e.g:

xRecurrence of known pathogens (measles, typhoid)

ximported cases of diseases with rare highly contagious and/or highly pathogenic agents (Ebola, Lassa fever)

xPandemics with variations of known pathogens (influenza pandemic)

xOccurrence of novel pathogens (Severe Acute Respiratory Syndrome, SARS)

In exceptional cases, however, epidemics can also result from accidental or intentional release, e.g:

xaccidental release, for example, as a result of a laboratory accident (as in individual cases following the SARS pandemic or the H1N1 influenza of 1977, the so-called "Russian flu", which was presumably the result of a laboratory release (Scholtissek et al., 1978; Zimmer and Burke, 2009))

xintentional release in the area of food extortion or with a bioterrorist background (the best-known example here is the "Anthrax Letters" in the USA in 2001)

The present scenario describes an exceptional epidemic event based on the spread of a novel pathogen. The hypothetical pathogen **"*Modes-SARS*"**, the characteristics of which are described in the information sheet (see Annex) and which is very closely related to the SARS virus. Past experience has shown that pathogens with novel properties that trigger a serious epidemic event can suddenly appear. (e.g. SARS coronavirus [CoV], H5N1 influenza virus, Chikungunya virus, HIV). A current example of a newly emerging pathogen is a coronavirus ("novel coronavirus"), which is not closely related to SARS-CoV. This virus has been detected in six patients since summer 2012, two of whom have died. One patient was treated in Germany and could be discharged as cured. In contrast to SARS-CoV, however, this virus does not appear to be transmissible from person to person, or only very poorly, so that the current risk assessment assumes that the risk of disease as a result of human-to-human transmission is low (status November 26, 2012). SARS-CoV and HIV were "new" for the human population, until then

unknown viruses with a high lethality, which for HIV could only be reduced after years and extremely costly research. In contrast, chikungunya viruses and H5N1 viruses were already known; however, properties altered by mutations in these viruses led to better transferability to humans. SARS-CoV and H5N1 are transmitted via the airways, Chikungunya is transmitted by a vector (mosquito). This makes these diseases more difficult to control than HIV, which is transmitted through sexual intercourse or contact with HIV-positive blood. While HIV control in Germany and other countries in Western Europe or North America has been relatively successful, this is not the case in many other countries with less good health care infrastructure - an indication of how essential control measures are in limiting the spread of the disease.

2. description of the event

The hypothetical *mode SARS virus* is identical to the natural SARS-CoV in almost all characteristics. The incubation period, i.e. the time from the transmission of the virus to a human being until the first symptoms of the disease appear, is usually three to five days, but can range from two to 14 days. Almost all infected people also fall ill. The symptoms are fever and dry cough, the majority of patients have difficulty breathing, changes in the lungs visible in X-rays, chills, nausea and muscle pain. Diarrhoea, headaches, exanthema (rash), dizziness, cramps and loss of appetite may also occur. The lethality rate1 is high at 10% of the patients, but varies in different age groups. children and young people
generally have milder courses of disease with a lethality rate of around 1%, while the lethality rate for people over 65 years of age is 50%. The duration of the disease also differs depending on the age of the patients; younger patients often get over the infection after only one week, while more seriously ill, older patients have to be hospitalized for about three weeks, and treatment needs of up to 60 days have also been described for SARS-CoV. This age-related course of SARS-CoV infection was not assumed for *mode SARS.* For modelling the numbers of patients and affected persons in the scenario, we assume that all age groups are equally affected.
Other parameters that may modify the course, such as human contacts and mobility in urban areas or social networks, were also not considered. Transmission is mainly via droplet infection, but since the virus can remain infectious on inanimate surfaces for several days, smear infection is also possible. As soon as the first symptoms appear, the infected persons are contagious. This is the **only difference** in transferability between hypothetical *mode SARS* and SARS-

[1] Letality describes the proportion of patients who die as a result of the infection.

CoV - the naturally occurring pathogen can only be transmitted from person to person if a person already shows clear symptoms of the disease. There are no drugs available for treatment, so that only symptomatic treatment is possible. A vaccine is also not available for the first three years. In addition to observing hygiene measures, protective measures in this sense can be taken exclusively by separating sick persons or persons suspected of being infected, and by using protective equipment such as protective masks, goggles and gloves.
However, secretion, isolation and quarantine are only of limited effectiveness, since very pronounced infectivity is already present at the onset of symptoms (Fraser et al., 2004)

The infectious disease spreads sporadically and in clusters. Transmission takes place mainly through household contacts and in the hospital environment, but also in public transport, at work and during leisure time.

For the *mode SARS scenario,* only a mutation-related change in the transmissibility of the virus is assumed; other possible variants, including those with multifactorial characteristics, would be conceivable (Reichenbach, 2008)[2] , but are not considered in this scenario.

2.1 Location/spatial extent

Where does the event happen?/Which area is affected by the event?
The event occurs globally (mainly Asia, North America, Europe).
The spread in Germany is via a trade fair city in northern Germany and a university city in southern Germany (Æ see 2.4 Duration and course). In the initial phase, a total of ten cases are registered in Germany. Two cases are of particular importance in this respect, as they are key players in dissemination (see
2.3 triggering events). The other cases concern travellers who contribute to the dissemination.
The distribution is nationwide over Germany, analogous to the population density. This assumption reflects a theoretical, simplified model; in the case of a natural "real" eruption, geographical differences would have to be expected, the complexity of which cannot be depicted here.

[2] The choice of a SARS-like virus is also justified by the fact that the natural variant in 2003 quickly pushed very different health care systems to their limits. The Green Paper quoted here has also undergone a similar thought experiment with a mutated SARS virus. The present *mode SARS scenario differs* in its characteristics and the assumptions derived from them for the extent of damage.

A map of the spatial distribution of the number of patients at the peak of the first wave of infection is attached to the scenario.

2.2 Timing

When does the event happen? (Season/occasional time of day)
The event begins in February in Asia, but its dimension/significance is only recognized there a few weeks later. In April the first identified *Mode SARS case* occurs in Germany. This point in time forms the starting point of the present scenario.

2.3 Triggering events

What events lead to this event?/What triggers the event? The pathogen originates from Southeast Asia, where the pathogen found in wild animals was transmitted to humans via markets. Since the animals themselves did not become ill, it was not apparent that there was any risk of infection. Chains of infection set in motion by this zoonotic transmission could only be traced retrospectively; this was not possible in all cases.
Domestic pets and farm animals are not infectious by *Modi-SARS* and therefore do not contribute to the spread or maintenance of the chain of infection.

Two of the first cases brought into Germany concern persons who have contracted the disease in the same Southeast Asian country. One of the persons is flying to Germany that same evening to look after a stand at a trade fair in a large city in northern Germany, while the other person is flying back to Germany one day later to resume her studies in a university city in southern Germany after a semester abroad in China. These two persons are two of the index patients in Germany through whom the infection is further spread. [3] They are of particular interest because both persons come into contact with an extraordinary number of people and thus contribute greatly to the initial dissemination. There are further cases that are imported into Germany, so that a total of ten infected persons are assumed to be responsible for the first wave of infection.

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[3] The course of the SARS epidemic in 2003 showed that an extremely small number of cases can be sufficient to trigger global infection. For example, a doctor staying in a hotel in Hong Kong was identified as the primary index patient for four clusters of SARS cases and two cases that did not give rise to further infection (WHO, 2003). This index patient is known to have infected at least 13 other people (hotel guests and visitors). These infected people spread SARS in 27 countries within a very short time - for example, 225 people were infected in Toronto between February and June 2003, and their infections could be traced back to a single hotel guest. The Toronto Health Department counted over 2000 suspected cases and over 23,000 people were quarantined (see reference events).

2.4 Duration and course

How long does the event and/or its direct effects last?

New infections are to be expected until a vaccine is available. The present scenario is based on an overall period of three years, assuming that after this period a vaccine is developed, released and available in sufficient quantities. Over the course of the three years, the pathogen changes through mutations in such a way that even people who have already experienced an infection become susceptible to it again. This results in a total of three waves of disease of varying intensity.

What period of time after the beginning/occurrence of the event is to be taken into account when determining the extent of the damage?

The extent of the damage is calculated as a sum for the entire three-year period.

How does the event unfold?

Starting with the first cases in northern and southern Germany, the pandemic is spreading in waves with increasing numbers. In principle, a correspondingly higher incidence of disease can be expected, particularly in conurbations, due to the high population density and patterns of physical activity (high mobility, use of mass transport, etc.).

It is assumed that each infected person infects an average of three people and it takes three days for the next transmission to occur. So-called "Super Spreaders" are not taken into account here. [4]

Furthermore, it is assumed that the population is fully susceptible, i.e. susceptible to the virus. A reduction in the number of susceptible individuals is achieved by passing through the infection. The number of people who can be infected decreases because those who are ill die or develop temporary immunity. The spread is also slowed and limited by the use of anti-epidemic measures. Such measures include quarantine for contact persons of infected persons or other isolation measures such as the treatment of highly infectious patients in isolation wards, taking into account special

[4] So-called "super spreaders", as described in the spread of SARS, are persons who infect more than ten other people. These cases are exceptions, but they can have a significant effect on the spread. It is not possible to predict whether Super Spreaders will exist and if so, what part they will play in the spread of infection. In order to reduce complexity, super spreaders were therefore excluded for the present scenario in order to allow an assessment of the course of events at all.

infection control measures. Means of containment include school closures and cancellation of major events. In addition to these measures, which can be ordered according to the Infection Protection Act, there are other recommendations that contribute to personal protection, e.g. for occupationally exposed persons, such as adherence to hygiene recommendations. The anti-epidemic measures begin after ten patients in Germany have died of the infection. The arrangement of the measures is first in the regions where cases occur; the population implements the measures differently depending on their subjective perception. In general, measures between day 48 and day 408 are described as effective. This results in effective anti-epidemic measures in a population where there is no immunity to the virus (fully susceptible), following course:[5]

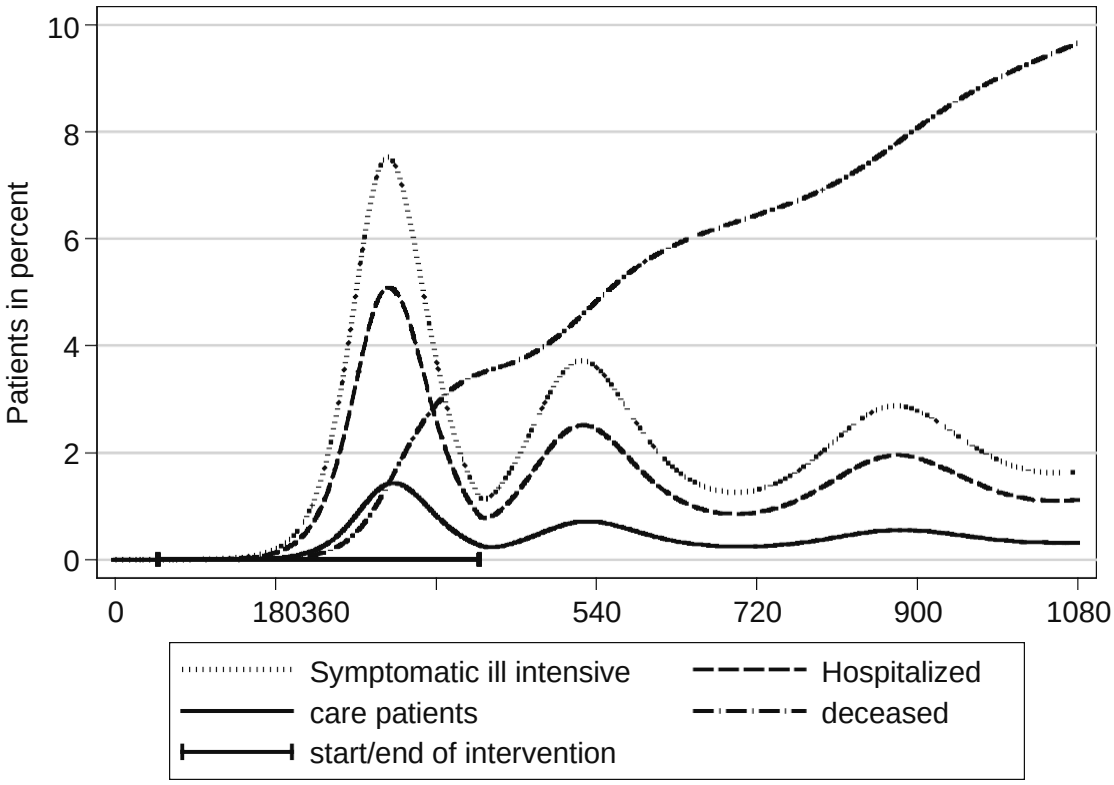

Figure 1

[5] The modelling of the course is based on the following assumptions: The total population is assumed to be 80 million. On average, the latency period is 3 days, the time from the onset of infectiousness to the manifestation of symptoms is 0.1 days, the length of the infectious phase is 13.1 days, the duration of the illness is 13.5 days; for persons requiring hospitalization, the duration is 19 days, the average intensive care is 13.5 days. It is believed that a person is immune for 360 days after experiencing infection with *Mode SARS*, after which that person can be reinfected by a mutated version of the virus. The modelling is based on population density, it does not take into account factors such as different disease courses in different age groups or different mobility (of age groups or in certain regions). It is a Susceptible-Infected-Recovered (SIR) model, created with Stata 12 software.

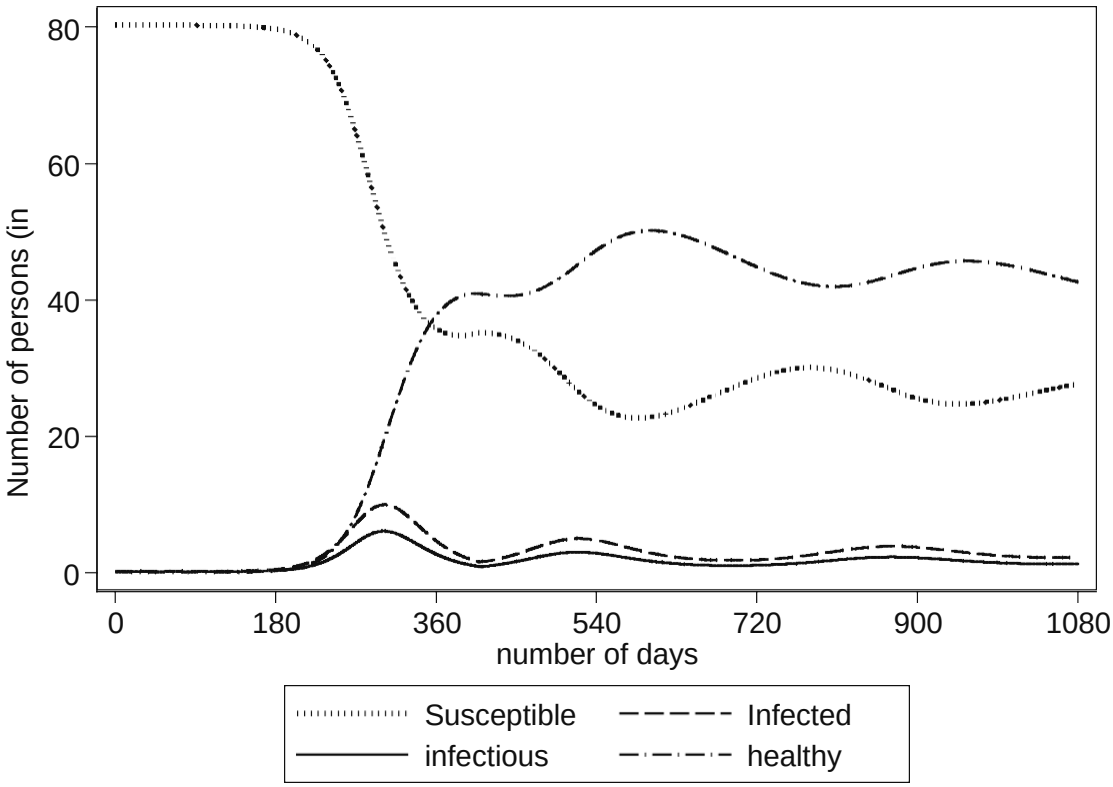

Figure 2

Images: Course of the pandemic over time.

The illustrations show the course of the eruption in a highly simplified form. Percentage figures are shown in Fig. 1, which shows the number of patients in relation to the total population at a given time, the number of hospitalised patients and the number of people requiring intensive care. The figures for deceased persons accumulate over the time. Figure 2 shows the absolute number of people affected. For example, before the pandemic begins, it is assumed that there will be around 80 million susceptible persons (total population, as there is no basic immunity). The curve of the susceptible persons moves in waves, since they become susceptible again, i.e. can be re-infected, despite having undergone the first infection due to a virus mutation.

The development of the spread in terms of the number of infected persons is therefore as follows:

Date	**Maximum number of symptomatically ill persons at the peak of the waves (to at the same time on a certain date)**	
	total	of which liable to hospitalization6 (intensive care)
on day 1	10	0
§ during the day 300 (1st wave)	§ Article 6 0Lllions	§ 4.1 million (§ 1.1 million)
§ during the day 520 (2nd wave)	§ 3 million	§ 2 million (§ 0.6 million)
§ during the day 880 (3rd wave)	§ 2.3 million	§ 1.6 million (§ 0.4 million)

Table 1: Number of patients at the peak of the event.

During the first wave (days 1 to 411) a total of 29 million people in Germany fall ill, during the second wave (days 412 to 692) a total of 23 million and during the third wave (days 693 to 1052) a total of 26 million people in Germany. For the entire three-year period used as a basis, at least 7.5 million deaths are to be expected as a direct result of the infection. In addition, the mortality rate of both those suffering from *Modi-SARS* and other diseases and those in need of long-term care increases, as they are no longer able to receive adequate medical care or nursing due to the overburdening of the medical and nursing sector (cf. section 3. - here: health care).

About 10% of the sick die. The pool of people who can be infected and thus potential carriers of the infection becomes smaller over time, as people who were infected and have since recovered are now initially immune to the pathogen, while others have died of their disease. After a peak, the rate of new cases also falls because the population in general reacts to the massive incidence of disease with increased (self-) protective measures. As a result of these measures, the number of new cases decreases, which leads to a decline in individual protective measures (due to a lower subjective risk perception), which in turn increases the number of new cases. These interactions contribute to the appearance of new

[6] "Hospitalised" is to be understood in the medical sense.

virus variants contribute to a course with several highlights. New cases are expected until a vaccine is available (36 months).

The enormous number of infected persons whose illness is so serious that they should be hospitalised or would require intensive medical care in hospital exceeds the existing capacities many times over (see section CRITIS, Health Sector, Medical Care). This requires comprehensive screening (triage) and decisions as to who can still be admitted to a clinic and treated there and who can no longer be treated there. As a consequence, many of the people who cannot be treated will die. [7]

Excursus: Course without anti-epidemic measures

The scenario presented here is based on the assumption that early on in the course of the epidemic, anti-epidemic measures are introduced which lead to each infected person infecting on average not three but 1.6 persons. Countermeasures are only adopted for the period from day 48 to day 408.
If one were to assume that no countermeasures would be taken and each infected person would infect three more people (until the vaccine is available), one would expect an even more drastic course. On the one hand, the absolute number of people affected would be higher, and on the other hand, the course would also be much faster. While in the model presented the peak of the first wave is reached after about 300 days, this would be the case after about 170 days without anti-epidemic measures. This gain of time through anti-epidemic measures can be used very efficiently, e.g. to produce and distribute personal protective equipment and inform about its correct use.
The number of people affected differs significantly in both scenarios. When protective measures are introduced and take effect, around 6 million (1st wave), 3 million (2nd wave) and 2.3 million (3rd wave) are ill at the peak of each wave. Without countermeasures, the figures are around 19 million (1st wave), around 6.5 million (2nd wave) and around 3.3 million (3rd wave). The figures for hospitalised patients and patients requiring intensive care are similar.

[7] So far there are no guidelines on how to deal with a mass influx of infected persons in the event of a pandemic. This problem requires complex medical, but also ethical considerations and should not be considered in a special crisis situation.

2.5 Predictability/alerting/communication

Is the event expected?

The occurrence of new diseases is a natural event that will occur again and again. In practice, however, it is not possible to predict which new infectious diseases will occur, where they will occur and when they will occur. A specific forecast is therefore not possible.

The pathogen *Modi-SARS* was discovered only a few weeks before its first appearance in Germany. The official warning via the regular WHO reporting channels is only issued at the time when the first two diseases are already detected in Germany.

To what extent can the authorities prepare for the event?

The discovery of the pathogen only becomes known to the German authorities a few days before the first case of the disease in Germany. Accordingly, initially only existing plans/measures can be activated. The Infection Protection Act (IfSG)[8] applies, according to which two or more similar diseases for which an epidemiological link is probable or suspected are subject to notification (§ 6 para. 1 sentence 1 no. 5 IfSG). In addition, depending on the epidemiological situation, the BMG may limit or extend the obligation to report (§ 15 IfSG) (Uhlenhaut, 2011). At the international level, the International Health Regulations (WHO, 2005), which are legally binding guidelines for the control of infectious diseases, apply.

At national level, efforts are being made to develop pandemic influenza plans, in particular since the increased occurrence of human cases of avian influenza ('avian influenza') of the H5N1 type. There is a national influenza pandemic plan (RKI, 2007), which consists of three parts:

1. Overview of the measures
2. Phase oriented tasks and recommendations for action
3. Scientific connections

On this basis, separate pandemic plans have been drawn up at Länder and municipal level (e.g. B. City of Frankfurt am Main, 2008, Ministry for Social Affairs of Lower Saxony, 2006). In addition, many large companies and institutes have developed their own plans to reduce absenteeism due to illness and to ensure working ability, e.g. through teleworking. [9]

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[8] The control and prevention of human infectious diseases is regulated by the public health service on the legal basis of the Seuchungsrechtsneuordnungsgesetz (SeuRNeuG) and here in particular in the Infektionsschutzgesetz (IfSG), which is incorporated in Article 1.

[9] Cf. Federal Office for Civil Protection and Disaster Assistance 2010, Federal Ministry of the Interior 2005.

Loss of working time can have various causes; on the one hand, the employee himself may have fallen ill, but on the other hand he may also stay away from the workplace to reduce his risk of infection (e.g. on public transport, but also when in contact with colleagues), or the care of sick relatives may be the reason.

Can the population prepare for the event?

Once it has been recognised that the pathogen is transmissible via the respiratory tract, the population is informed very quickly about general protective measures (e.g. follow hygiene rules, avoid mass gatherings, avoid public transport, follow measures ordered by the IfSG). It is questionable to what extent the communicated recommendations/instructions are implemented, e.g. to what extent people have protective equipment and can use it correctly. The actions of people in situations of danger or disaster are determined by a number of different factors which also influence each other, including

- own risk perception
- social context (family, job, ...)
- socio-economic status (income, class and milieu, etc.)
- Educational level

Communication:

The time between the German authorities becoming aware of the pathogen and the dissemination of initial information by the media is approximately 24 hours. Accordingly, uncertainty among the population is to be expected. In addition, a (more or less qualified) exchange via new media (e.g. Facebook, Twitter) can be expected.

The event requires the production of information material which must be continuously adapted to the situation and which is given to the population via various media (e.g. print media, television, social media). In the initial phase, the occurrence of the disease and the associated uncertainties are communicated (e.g. unknown pathogens, extent, origin, dangerousness cannot be described precisely, countermeasures can only be formulated in general terms). New findings are always passed on promptly. Care is taken to ensure that the questions and fears of the population are adequately addressed.

It is to be assumed that crisis communication is not always adequately successful. For example, contradictory statements from different authorities/agencies can make it difficult to build trust and implement the necessary measures. Only if the

If the population is convinced of the usefulness of measures (e.g. quarantine), these can be implemented. [10]

2.6 Official measures

In addition to informing the population, the authorities take measures to contain and manage the event, building on existing plans and past experience. Crisis teams are convened promptly and take over the management and coordination of the measures. The forward-looking assessment of the situation and the corresponding planning of defensive measures are coordinated among all levels involved.

Public health measures include isolation, isolation and quarantine. Secretion describes the spatial and temporal segregation of sick persons, suspects of disease and infection from each other and also from susceptible, non-infected persons, but also in groups (cohort isolation, -quarantine, domestic quarantine). Quarantine defines the isolation of persons not in need of treatment, without including the sick or suspected sick. The term isolation should exclusively describe the inpatient treatment of sick people and suspected illnesses in an isolation or special isolation ward (Fock et al., 2007). A precise definition and precise use of these terms is important for communication at all levels - especially since these terms are not or only insufficiently described in the IfSG.
It is important to identify and find contact persons suspected of being infected, to hold (sometimes difficult) discussions with them and to implement measures provided for under the IfSG. If a contact search by the health authorities is no longer possible due to the large number of cases, an individual case report is no longer useful and can be cancelled.

The competent authorities, first and foremost the public health authorities and there mainly the medical officers, must take measures to prevent communicable diseases. The IfSG allows

[10] It is generally critical to maintain a positive flow of information. Without this, for example, greater insecurity, the early lifting of protective measures in the personal environment and thus new outbreaks may occur. For the acceptance of the communicated messages it is essential that the authorities communicate "at eye level" with the population. The citizen should be seen as a partner, not as a "recipient of orders". Communication with different target groups is also necessary; different demographic groups must be addressed in different ways (also: multilingual information material).

among other things, restrictions of basic rights (§ 16 IfSG), such as the right to the inviolability of the home (Article 13 (1) GG). Within the framework of necessary protective measures, the fundamental right of freedom of the person (Article 2 (2) sentence 2 GG) and the freedom of assembly (Article 8 GG) can also be restricted (§ 16 (5) to (8) and § 28 IfSG). In addition to these measures to be ordered directly by the public health officer, the Federal Ministry of Health can order by statutory order that threatened parts of the population have to participate in protective vaccinations or other measures of specific prophylaxis (Article 20 (6) IfSG), which can restrict the right to physical integrity (Article 2 (2) sentence 1 GG).

In the course of the event in question, these tasks present the competent authorities with major or sometimes impossible challenges. This applies both to human and material resources and to the enforceability of official measures.

3. effects on CRITIS/supply

Preliminary remark:
The critical infrastructures listed below are complex systems on which a variety of supply functions depend. In principle, it can be assumed that the impairment of individual infrastructure sectors and industries will also have an impact on other infrastructures and their supply services. This circumstance cannot be illustrated here in its complexity. Since the risk analysis is conducted from the overarching perspective of the Confederation, the expected effects on the area of CRITIS/provision are presented below in a generalised, qualitative manner. Significant interrelationships are discussed in the explanations of the individual sectors. [11]

As described in 2.4, the event occurs in three waves of illness. During the first wave, particularly acute effects can generally be expected in all the areas mentioned below, as up to 8% of the total population falls ill at the same time. The risks of infection and transmission differ according to occupational areas. The following explanations are based on the assumption that this is also reflected in the

[11] This is based on well-founded assumptions and expert assessments of the federal authorities involved. In the future, it is desirable to include direct expertise of KRITIS operators in the process of scenario development in order to be able to make more concrete and validated statements. For quantitative statements, additional, more in-depth analyses would be necessary, which would also have to take into account the complexity of the variously interwoven infrastructures.
Correspondingly detailed background information is not available at federal level for many areas of responsibility.

working population. In addition, there are staff shortfalls due to the care of sick relatives, the care of children etc. or the fear of infection.

As sick leave increases, approved holidays and further training have to be postponed, operational procedures are adapted accordingly, non-urgent maintenance work etc. is reduced, and the possibilities offered by sections 14 and 15 of the Working Hours Act are used. The increasingly high number of sick people and absences due to the care of sick relatives or the fear of infection have an impact on personnel availability in all industries and sectors. This is especially true for areas with many personal contacts.

In the long term it can also be assumed that there will be fundamental difficulties in the operation of the infrastructure due to the permanent loss of personnel (deceased). Conversely, experiences from the first wave will lead to appropriate adjustments and measures in the operation of critical infrastructures.

In principle, it can be assumed that the maintenance of supply is given the highest priority and that the utilities make corresponding efforts and that therefore no large-scale supply disruptions are to be expected. In some cases, however, longer-lasting disruptions can be expected, as services are not always available to the usual extent due to staff shortages. This applies in particular to personnel-intensive areas and areas with low personnel redundancy in key positions.

In many places, the operation of critical infrastructures relies on highly qualified and specialised personnel, the failure of which can have far-reaching consequences (e.g. in the area of transmission network control, air traffic control, etc.) and could result in supply shortfalls or bottlenecks of a nationally relevant extent. The following estimates are based on the assumption that the filling of these key positions can still be guaranteed, i.e. that not too high a proportion of these staff will fall ill at the same time within the period under review. This restriction is necessary because this scenario would have to be assessed significantly differently under a different assumption.

In addition, in view of the many international interdependencies, supply services from other countries are also of great importance for Germany. Many goods and services are provided worldwide by only a few key producers.

Thus, failures in the area of imported goods and raw materials could lead to noticeable bottlenecks and cascade effects in Germany as well.

The following observations refer to the first wave of the infection, as this is where the largest number of people who fall ill at the same time occurs.

ENERGY sector

	Industry	Explanations
X	Electricity	The supply can basically be maintained. Æ Cross-reference Logistics
X	Gas	The supply can basically be maintained.
X	Mineral oil	The supply can basically be maintained.

Information and Telecommunications sector

	Industry	Explanations
X	Telecommunications	The supply (fixed network, mobile telephony, Internet) can basically be maintained.
X	Information Technology	The supply can basically be maintained.

TRANSPORT AND TRANSPORT SECTOR

	Industry	Explanations
X	Aviation	There are restrictions on air traffic. In freight and especially passenger transport, flights will be cancelled because personnel planning only allows a certain degree of flexibility due to the special requirements (rest periods, different whereabouts of crews, etc.). Due to the basically many personal contacts in the areas service and security personnel, airlines and airports are experiencing increased staff shortages. At the same time, demand is declining in both passenger and business transport (illness, fear of infection, travel warnings).
X	Maritime navigation	The supply can basically be maintained. Freight transport on the high seas is only slightly affected.

		Although there are also staff shortfalls here, these are lower than in other sectors (few external contacts, additional infection protection measures). Æ Cross-reference Logistics (seaports)
X	Inland navigation	The supply can basically be maintained. Freight transport by inland waterways is only slightly affected. Although there are also staff shortfalls here, these are lower than in other sectors. Æ Cross-reference Logistics (inland ports)
X	Rail transport	Rail transport is affected by staff shortages. Connections fail, there are delays in operation. This also has an impact on commuters/travellers who cannot reach their workplace/destination by train. At the same time, many people will avoid travelling by train or will not be able to travel by train due to their illness, so that a certain amount of compensation is achieved. Æ Cross-reference Logistics
X	Road traffic	Individual transport is increasing due to the loss or avoidance of mass transport. Overall, there is an increasing number of traffic disruptions and capacity bottlenecks in road transport. Æ Cross-reference Logistics
X	Logistics	Failures at individual points within the supply chain multiply due to the complex interdependencies. Staff shortages therefore sometimes lead to considerable restrictions or interruptions of supply chains. This has corresponding effects on production processes and other infrastructure sectors. Certain transport capacities are used to transport goods with a special priority (e.g. food, energy sources). [12]

[12] The Act to Secure Transport Services (Transport Services Act - VerkLG) serves to ensure sufficient transport services in special (crisis) situations. On the basis of this law, providers of transport services (entrepreneurs) can be obliged to provide corresponding services and ancillary services. This also includes the provision of means of transport and facilities, but not the provision of personnel.

HEALTH sector

	Industry	Explanations
X	Medical care	The high number of consultations and treatments poses immense problems for both hospitals and general practitioners. Medical care is collapsing nationwide. The personnel and material capacities are not sufficient to maintain the accustomed level of care. The current capacity of 500,000 hospital beds (pure number of beds, some of which are already occupied by other patients, the number of beds could be slightly increased by provisional measures) are compared to more than 4 million patients in the period under consideration (1st wave) who would have to be treated in hospital under normal circumstances. The majority of those affected cannot therefore be adequately cared for, so that most of those affected must be cared for at home. Emergency hospitals will be set up. In the health care sector, too, there is an above-average number of staff shortfalls (e.g. due to increased risk of infection, psychosocial stress), while at the same time the need for personnel has increased significantly. Pharmaceuticals, medical devices, personal protective equipment and disinfectants are in increasing demand. As hospitals, doctors' surgeries and public authorities are generally dependent on quick replenishment, but industry is no longer able to fully meet demand, bottlenecks arise. Due to the high mortality rate, the burial of the deceased also is a major challenge (mass accumulation of corpses, concern about infectivity).
X	Drugs and vaccines	A vaccine does not initially exist and will only be available after about three years. The stocks of medicines for treating the symptoms are sufficient replacement purchases are ordered promptly, but the international pharmaceutical industry is reaching the limits of its production capacity.
X	Laboratories	Work ability is given.

WATER sector

	Industry	Explanations
X	Public water-supply	The supply can basically be maintained.
X	Public sewage-removal	The supply can basically be maintained.

FOOD sector

	Industry	Explanations
X	food industry	The production of food is not possible in the usual quantity and variety. Disease-related losses in the agricultural sector (especially in small and medium-sized enterprises) sometimes lead to significant losses in agricultural production. The loss of personnel due to illness, which cannot be compensated for everywhere, sometimes leads to considerable effects in the processing industry, especially at peak times (e.g. harvest time). Æ Cross-reference Logistics
X	Food Retailing	The supply of food is not possible in the usual quantity and variety. Shop closures are to be expected, but not across the board. Due to the generally large number of personal contacts, there are increased staff absences. Bottlenecks can only be partially compensated. Care institutions (e.g. hospitals, nursing homes) can be maintained in principle. However, individual care is sometimes severely restricted regionally. Æ Cross-reference logistics (due to limited storage capacity, businesses are dependent on uninterrupted supply)

FINANCIAL AND INSURANCE sector

	Industry	Explanations
X	Banks	Work ability is given.
X	Stock exchanges	Work ability is given.
X	Insurance	Work ability is given.
X	Financial service provider	Work ability is given.

Sector STATE AND ADMINISTRATION

	Industry	Explanations
X	Government and administration	Personnel bottlenecks in government and administration can be absorbed by adjustments. Non-urgent and non-existential tasks are only dealt with on a subordinate level, so that in particular the areas "public safety and order" and "social affairs" to sufficient be able to fall back on personnel capacities.
X	Parliament	Bundestag and state parliaments can continue their work.
X	Judicial institutions	Despite the staff shortages due to holiday blocks and rescheduling can continue to be managed safely.
X	Emergency/rescue services including Civil Protection	Due to the extensive and long-lasting situation, all forces of the German emergency and rescue system, including disaster control, are under heavy strain. The assistance potential of the federal government (e.g. THW, Federal Police, Federal Armed Forces) is also used to provide support in all areas. Despite maximum commitment, the tasks cannot be mastered, especially during the peak of the disease waves. The mobilisation of volunteer potential is not sufficiently successful, especially as there are conflicts of interest in Germany's aid system, which is mainly based on voluntary work.

Sector MEDIA AND CULTURE

	Industry	Explanations
X	Radio (television and radio), printed and electronic press	The media can continue their coverage. Personnel bottlenecks are cushioned by the fact that the immediate reporting of news events becomes the focus of the editorial offices. Capacities will be reduced in the areas of culture, sport and entertainment. Official notices, recommendations and instructions are transmitted by the public media.
X	symbolic Buildings	Symbolic buildings are not affected by the pandemic.

Additional notes:

disposal:
There are considerable problems in the area of waste disposal (e.g. refuse collection).

wholesale and retail:
The supply of goods for daily use is not possible in the usual quantity and variety.

4. objects of protection concerned

Which objects of protection are directly or indirectly affected by the event?
Note: At this point, it is generally recorded for which objects of protection effects/damage are to be expected from the event and from the failure of critical infrastructures. The actual extent of damage is determined in a separate step of the risk analysis.

<u>Effects on the protected good HUMAN:</u>

Dead (M1):
At least 7.5 million deaths can be expected over the entire period (cf. Chapter 2.4).

Injured/sick people (M2):

During the first wave of the disease alone, 6 million people are expected to fall ill at the same time. Over the entire period, the number of people suffering from the disease is still significantly higher.

People in need of help (M3):

Where isolation, seclusion, quarantine are necessary, the persons concerned are dependent on appropriate external care. Similarly, the provision of food and medicines, especially for the elderly and sick, could be made more difficult and may require state intervention, e.g. because nursing staff are not protected by vaccination (i.e. more difficult working conditions, additional work, etc.). Exemplary, possible cases:

- People in domestic quarantine must be cared for and (their health parameters) controlled - without these measures the quarantine will not be maintained
- Elderly people or people with pre-existing conditions are particularly unsettled by the development and avoid going to shops
- People who have previously looked after elderly or sick neighbours (shopping, pharmacy visits) are reducing this commitment for a variety of reasons (e.g. they are not able to take care of the elderly or sick neighbours).
  B. frightened himself; too busy with his own situation; leaving home to look after his own relatives)
- Delivery service of pharmacies collapses

Missing (M4):

Missing persons as a result of the event are to be expected to a lesser extent, e.g. persons who die unnoticed due to the illness and whose fate cannot be clarified.

<u>Effects on the ENVIRONMENT as an object of protection:</u>

damage to protected areas (U1):

Direct effects on protected areas are not expected.

Damage to surface water/ground water (U2):

Direct effects on surface waters/groundwater are not expected.

Damage to forest areas (U3):

Direct impacts on forest areas are not expected.

damage to agricultural land (U4):

Direct impacts on agricultural land are not expected.

damage to farm animals (U5):

In individual cases, farm animals can be harmed.

Impacts on the ECONOMY as a protected good:

The economic effects cannot be concretely assessed here, but could be immense. [13] Since at least 7.5 million people die in the course of the event as a whole, the death of a large number of employed persons must be expected despite the age distribution of the lethality rate. If, for example, four million working people were to die, this would be about ten percent of the total workforce; this loss would be clearly noticeable to the national economy and would be associated with a severe slump in gross domestic product.

Public sector (V1):

Massive costs for the public sector are to be expected, including the consumption of medical material and medicines and the development and procurement of a vaccine. The loss of economic output is expected to result in lower tax revenues. In conjunction with the rise in health care costs, this is likely to place a considerable burden on the social security systems, especially the statutory health insurance system.

Private economy (v_2):

With losses in economic performance due to sickness rates among staff or deaths among company employees, additional costs due to adjustment measures to maintain operations, higher costs for transport and logistics or

Restrictions in the transport of goods and a changed (cautious) consumption and investment behaviour of the population and other companies can be expected, as well as

[13] Even the evaluation of known outbreaks, which in their extent do not correspond to the *mode SARS scenario* can only be regarded as an estimate in this respect. Examples are E.coli outbreaks in the USA, which cost around 1.6 billion US dollars between 1991 and 1999, a cholera outbreak in Peru (around 770 million US dollars) or the pneumonic plague in Surat, India. More than 50 people died in this outbreak, there were more than 5,000 infected (lethality ~ 1%). However, it was primarily the reaction of the population that was the problem, with around 300,000 people reported to have fled the region; the economic damage is estimated at around US$ 1.7 billion. The appearance of SARS in 2003 not only impressively demonstrated how a novel pathogen can very quickly push even the most modern infrastructures to their limits. The economic damage was also considerable. The financial damage in Beijing, for example, is estimated at around 1.4 billion dollars, which is around 300 times more expensive than the care of SARS patients in the city.

officially imposed restrictions on international trade and air traffic/travel and a decline in tourism.

In general, it must be taken into account that companies may no longer be able to compensate for the effects of the pandemic even with good planning and preparation (general rationalisation tendencies: thin staffing levels, dependence on suppliers, just-in-time production, etc.). This can even lead to a standstill of production chains worldwide.

In view of the diverse international interdependencies, supply services from other countries are also of great importance for Germany. Many goods and services are provided worldwide by only a few key producers. Thus, failures in the area of imported goods and raw materials could lead to noticeable bottlenecks and cascade effects in Germany as well.

Private households (V3):
As the event is not expected to cause any direct damage to private property, it is not to be assumed that restoration measures will be necessary.
For private households where employed persons die or become disabled as a result of the event, the economic impact is expected to be correspondingly severe.

Effects on the object of protection IMMATERIAL:

Public safety and order (I1):
It can be assumed that the uncertainty of the population, which is to be expected in the event of a severe pandemic, will also have an impact on public safety and order.

However, the impact of such a pandemic on society is difficult to assess and depends on various factors, such as the way in which the authorities act and communicate, media coverage, etc. In the present scenario it is assumed that the majority of the population shows solidarity and tries to reduce the effects of the event by mutual support and consideration. Similar solidarity-based behaviour has often been observed in other extreme situations. Nevertheless, it cannot be ruled out that increasing insecurity and the feeling of being abandoned by the authorities and the health system may encourage aggressive and antisocial behaviour.

This includes for example [14]

x Burglary/theft, e.g. to obtain medication (e.g. antibiotics) etc.

xLoooting and vandalism

xTrafficking in counterfeit medicines

xActions against authorities or health care institutions (out of anger, e.g. because of allegedly unfair treatment in medical care)

Whether people resort to such means depends on various factors. If a person gets into a conflict of objectives, the probability of such a reaction increases (e.g. looting of a supermarket if this appears to be the only way to provide for one's own family, as well as looting of a pharmacy, etc.)

It is also possible that instructions from the police and other authorities are not followed (e.g. residence or hygiene regulations) or that representatives of these authorities are treated aggressively. Large-scale demonstrations or riots are unlikely to occur, as it is assumed that large gatherings of people are more likely to be avoided. However, this depends on the individual perception of risk.

Political impact (I2):

A high level of public interest is expected throughout the situation. The call for rapid and effective action by the authorities will be heard early. The search for "culprits" and the question of whether the preparations for the event were sufficient may still arise during the first wave of infection. Whether there are demands for resignation or other serious political consequences also depends on the crisis management and crisis communication of those responsible.

Psychological effects (I3):

Uncertainty among the population is to be expected. Behavioural changes can occur when people feel threatened. Here too, various factors come into play, such as the course of the disease, knowledge of the causes and specific risks, proximity to the cases that have occurred, etc.

Behavioural changes can be seen in:

xthe avoidance of crowds

xthe avoidance of public life in general

xthe change of residence (leaving the place of residence)

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[14] Cf. B. Quarantelli 2003, Geenen 2010.
There are no reliable findings on the long-term societal effects of such an event; there is still a need for research in this area.

xthe increase in calls to info hotlines

xthe increase in visits to the doctor

xthe change in buying behaviour

In addition, inadequate information of the population by the authorities can lead to increased mistrust of government action (especially as soon as treatment priorities become known or are established as a topic in the media without a plausible justification being properly communicated at the same time).

damage to cultural property (I4):

Direct effects on cultural property are not to be expected.

5. reference events

xSARS pandemic 2002/2003, mainly in Canada and some Asian countries.

xEHEC: 855 HUS diseases and 2,987 cases of EHEC gastroenteritis (without development of HUS) were recorded, a total of 3,842 diseases.

In Germany, there have hardly been any exceptional epidemic events in recent decades that have led to enormous material damage or loss of life. However, the example of SARS shows that such an epidemic can easily affect countries with high standards of development and health care.

Examples of described outbreak patterns of SARS:

xThe index patient infected 13 other hotel guests and visitors of Hotel M - these persons had no direct contact with the index patient.

xOne Hotel M guest infected 47 nursing staff and doctors, caused about 112 secondary infections and 26 tertiary cases.

xAn additional guest of the hotel infected 225 people in Toronto between February and June; subsequently, the Toronto Health Department counted 2,132 suspected cases; 23,105 contacts were quarantined (Breugelmanns et al. 2004).

xStudy among medical students in Hong Kong: whoever had visited a SARS patient in their area (before diagnosis of SARS) had a 7-fold increased probability of falling ill. All students who came within a meter of the patient became infected.

xFlight: 16 of 119 passengers (13%) became infected (laboratory-confirmed cases), 2 further suspected cases after a flight with a symptomatic person. The risk of getting infected was 3 times higher within a 3-row distance in front of the sick traveler.

xOne patient infected 45% of his contacts, these secondary cases infected 32% of their contacts.

x"Super Spreaders" (people who infect more than ten other people) were responsible for about ¾ of the cases in Hong Kong and Singapore.

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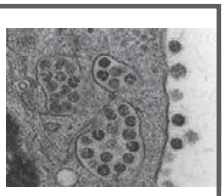
SARS Information



SARS coronavirus (coronavirus), intracellular and on the surface of verocells. Transmission electron microscopy, ultrathin section. Scale = 100 nm. Source: RKI Source: *Hans R. Gelderblom, Freya Kaulbars (2003)/RKI*

Pathogen: SARS corona virus (enveloped virus, 80-200 nm, positive strand RNA, approx. 30 kbase length).

Incubation period: 2-14 (usually 3-5) days

Infectiousness: Patients become infectious when symptoms are already pronounced, i.e. some time after the onset of symptoms, R015 is estimated to be 2.7 or between 2.2 and 3.7.
So-called Super Spreaders are not taken into account in the calculation. virus was cultured from respiratory secretions, stool and urine and detected in tear fluid.

symptoms: fever >38°C (100%), dry cough (100%), shortness of breath (80%), radiological changes, chills (73%), nausea (70%), myalgia (60%), diarrhoea, headache, exanthema, dizziness, cramps, loss of appetite

Fatalities: around 10% (1-50%, depending on age and secondary diseases)

Tenacity: In stool 1-2 days, in diarrhoea 4 days, on surfaces (fomite) days

Prophylaxis: Exposure prophylaxis (protective clothing, isolation, quarantine), no vaccine available

Therapy: only symptomatic, between 20 and 30% need intensive medical care, about 14% need artificial respiration, no antiviral drugs available. Fast therapy start for prevention/control of (bacterial) secondary infections improves the prognosis.

Duration: In 2002/3 the majority of patients could be discharged from hospital after 3 weeks, but in some cases it took 40-50 days. Patients over 60 years of age often had to be treated for 60 days, and fatalities accounted for about 50% in this group.

Properties that made SARS controllable

Late onset of virus excretion
Virus was isolated only in exceptional cases 3 weeks after disease onset, no transmission is reported later than 10 days after defervescence.
SARS has rarely been observed in young children
Chronic eliminators or asymptomatic courses are rare

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[15] R0: indicates the average number of cases infected by an infected person.

Mode SARS Information

Properties: same as SARS with the following exceptions:

Hypothetical pathogen: virus from the corona virus family

Incubation period: 3 days

Infectivity: Patients can excrete viruses immediately at the onset of symptoms, virus excretion begins after 3 days. Infectivity ends with the resolution of clinical symptoms, on average after 16 days.

symptoms: fever >38°C (100%), dry cough (100%), shortness of breath (80%), radiological changes, chills (73%), nausea (70%), myalgia (60%), diarrhoea, headache, exanthema, dizziness, cramps, loss of appetite

Fatalities: around 10% (1-50%, depending on age and secondary diseases)

Tenacity: In stool 1-2 days, in diarrhoea 4 days, on surfaces (fomite) days

Prophylaxis: Exposure prophylaxis (protective clothing, isolation, quarantine), no vaccine available

Therapy: only symptomatic, between 20 and 30% need intensive medical care, about 14% need artificial respiration, no antiviral drugs available. Fast therapy start for prevention/control of (bacterial) secondary infections improves the prognosis.

Duration : expected length of the infectious phase about 13 days, expected sick days about 13.5 days, days in hospital about 19, days in intensive care about 19. time from hospitalization to death: 28 days on average.

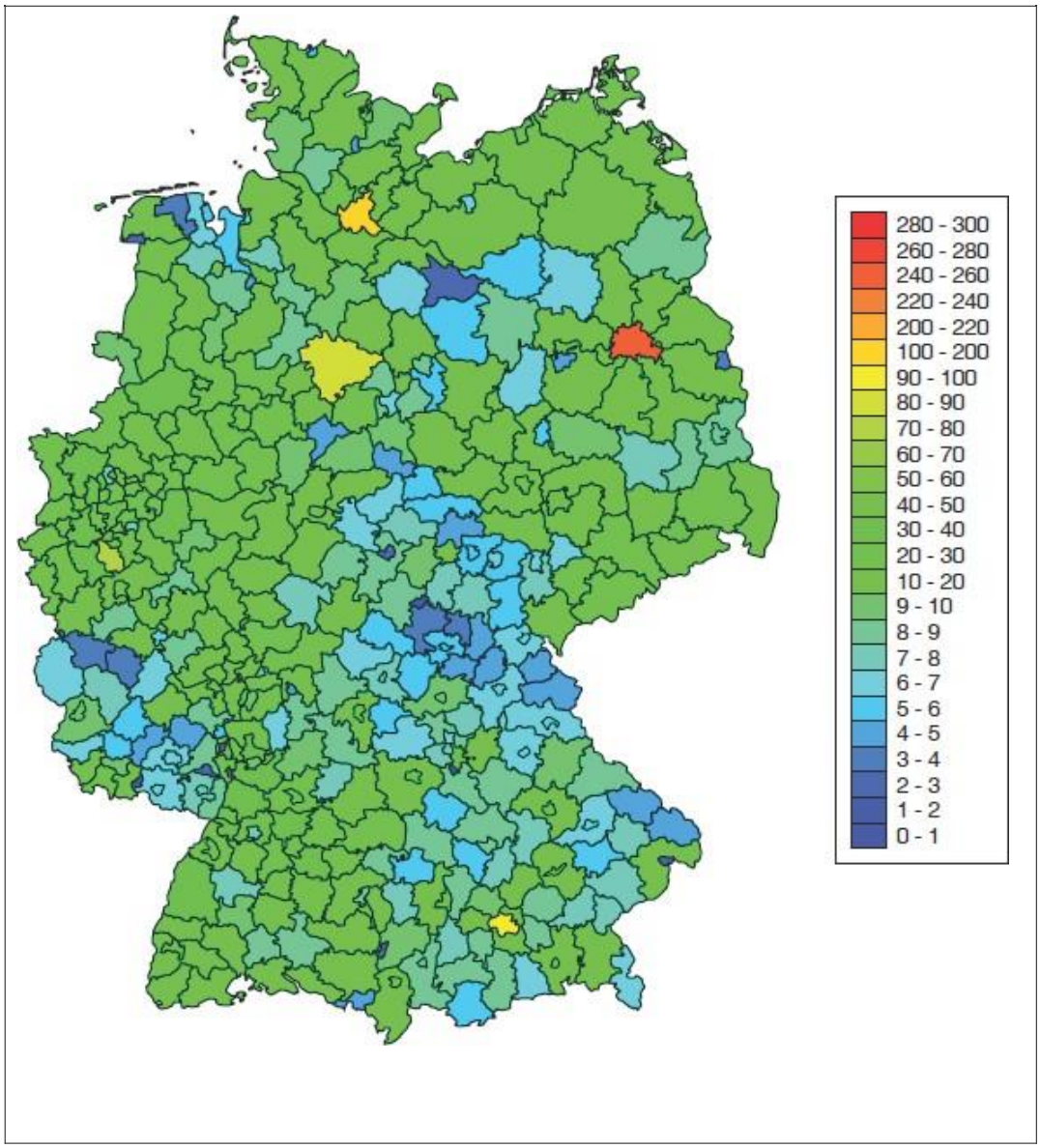
Anti-epidemic measures (secretion, masks, hygiene, etc.): were modelled from day 48 to 408, the measures reduce R0 from 3 to 1.6.

Mild course: is observed in about 5% of cases, asymptomatic course in about 2%.

Map of the spatial distribution of the number of people suffering from the disease at the peak of the first wave of the disease

Modes-SARS

Day 300, sick persons [in thousands]



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