Disaster Risk Management Summary Report – Czech Republic 2020
in accordance with Article 6 of Decision No 1313/2013/EU

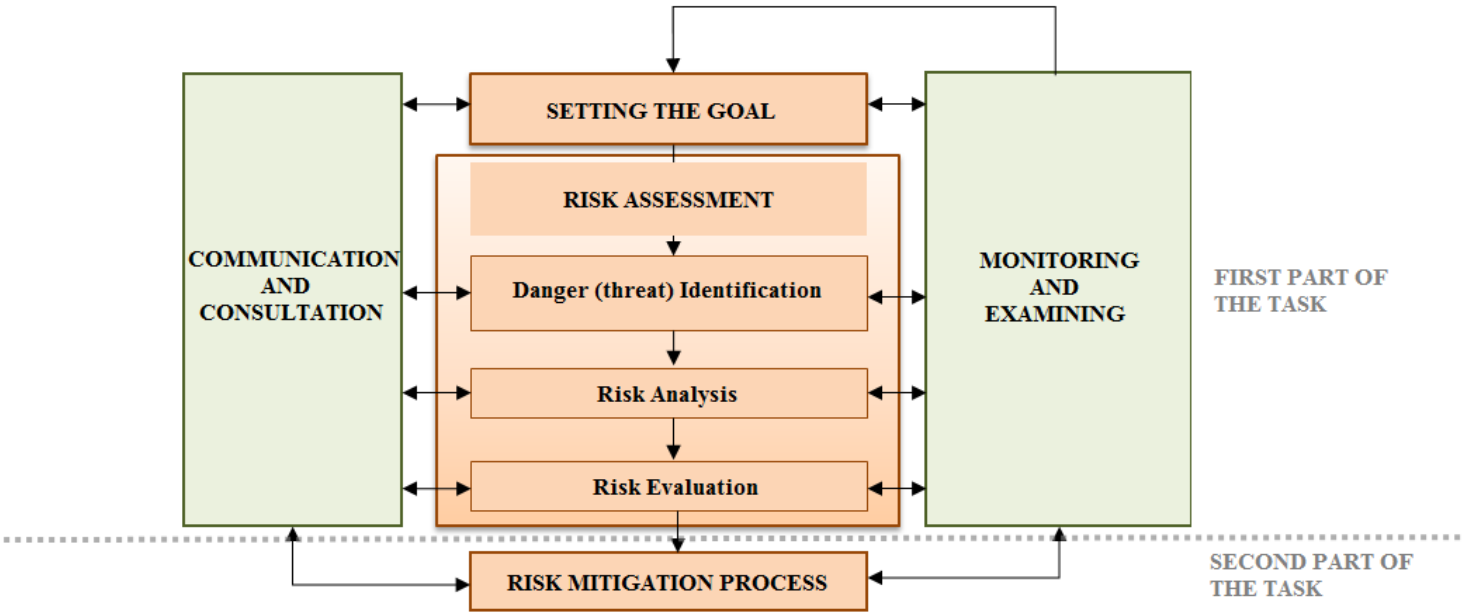
Part I: Risk Assessment

1.1 Risk assessment process

The threats we are facing nowadays are increasingly more complex, more difficult to understand and predict. This requires continuous adaptation of the response capabilities and the security system as such. Based on this premise, the government of the Czech Republic adopted in 2013 "Population Protection Concept" which included an assignment to perform a risk assessment for the Czech Republic and to reflect its outcomes into methodological and strategic documents in the field of security of the state. This task was scheduled to be finished in 2016 with the responsibility for its execution being given to the Ministry of Interior in collaboration with other ministries and central administrative authorities.

When it comes to its content, this assignment can be divided into two separate parts: the first one is to perform the risk analysis itself and the second one is to implement the gained knowledge and analytical outputs into the substantive documents steering the outlines and development of the security of the Czech Republic. The accountability for this task was entrusted to the DG FRS[1]. Its first step was the creation of FRS specialised task force comprising a number of experts in various fields who all contributed their expertise in the identification of threats that could develop into crisis situations. The first draft of the document was widely discussed on the expert level with the representatives of basically all central authorities and a number of local authorities. The finished document amended based on received commentaries was subsequently discussed in the Civil Emergency Planning Committee, State Security Council and later in April 2016 approved by the government[2].

The process itself comprises of several key activities (shown in the middle column in Picture 1 below), and cross-cutting activities including communication of relevant stakeholders, monitoring and verification, namely periodical revision. The main activity was the risk assessment consisting of threat identification, risk analysis and risk assessment.



Picture 1: Risk Assessment Process

[1] The List of Abbreviations is available at the end of this document
[2] Approved by the resolution of government No. 369 from 27 April 2016.

As a part of the preparation process, a detailed description of risk analysis processing including specific formulas and numbers was elaborated in a dedicated methodology for the purpose of the precise risk analysis execution[3].

Threat identification

In the beginning, a registry of all the 72 possible risks was established and the risks therein were divided into two categories: natural and man-made. To each of these risks, a responsible authority was assigned to perform a preliminary analysis. This resulted in assigning the estimated risk level (a number expressed as a product of expertly estimated probability and impact of the specific risk) and the subsequent division of the risks into low-level risks (value of 3 and less) and high-level risks (value of 4 and more).

The group of low-level risks has not been further examined; these risks are considered acceptable and not requiring any particular planning and measures. This category also includes some risks with potentially significant impacts (e.g. tsunami or volcanic eruption), but their probability of occurrence is so low in the conditions of the Czech Republic, that their value never exceeded 4, meaning very low risk. On the other hand, there are risks in this category with a very high level of probability of occurrence in the Czech Republic (e.g. soil erosion, extreme fog) whose impacts are considered so low that the combined value never reached a number high enough to include them into the high-level risk group.

Risk Analysis

In the second phase, a detailed multi-criteria analysis was performed for the group of high-level risks. Their probability of occurrence (i.e. how often a large-scale event can occur; the worst possibility is counted) was assessed and assigned a value from a ten-point semi-quantitative scale, with the value of 1 representing the occurrence of once per every 1000+ years and the value of 10 representing the occurrence of once per 1-6 months. Then the probable impact including loss of lives, health, environmental, economic, and social consequences was calculated using the following formula:

$$I = (K_O \times VK_O) + (K_{ŽP} \times VK_{ŽP}) + (K_E \times VK_E) + (K_S \times VK_S)$$

Where:

K_O = coefficient of loss of lives and health

$K_{ŽP}$ = coefficient of impact on the environment

K_E = coefficient of economic impacts

K_S = coefficient of social impacts

Value coefficients (V) are based on the Fuller method and are set to 0,4 for lives and human health and 0,2 for other protected interests. The result of this equation represents the numerical value of impact. From these two numbers (probability and impact) it was possible to calculate the risk level using the following formula:

$$R = P \times I$$

Where: R = risk level, P = probability, I = impact

Risk Evaluation

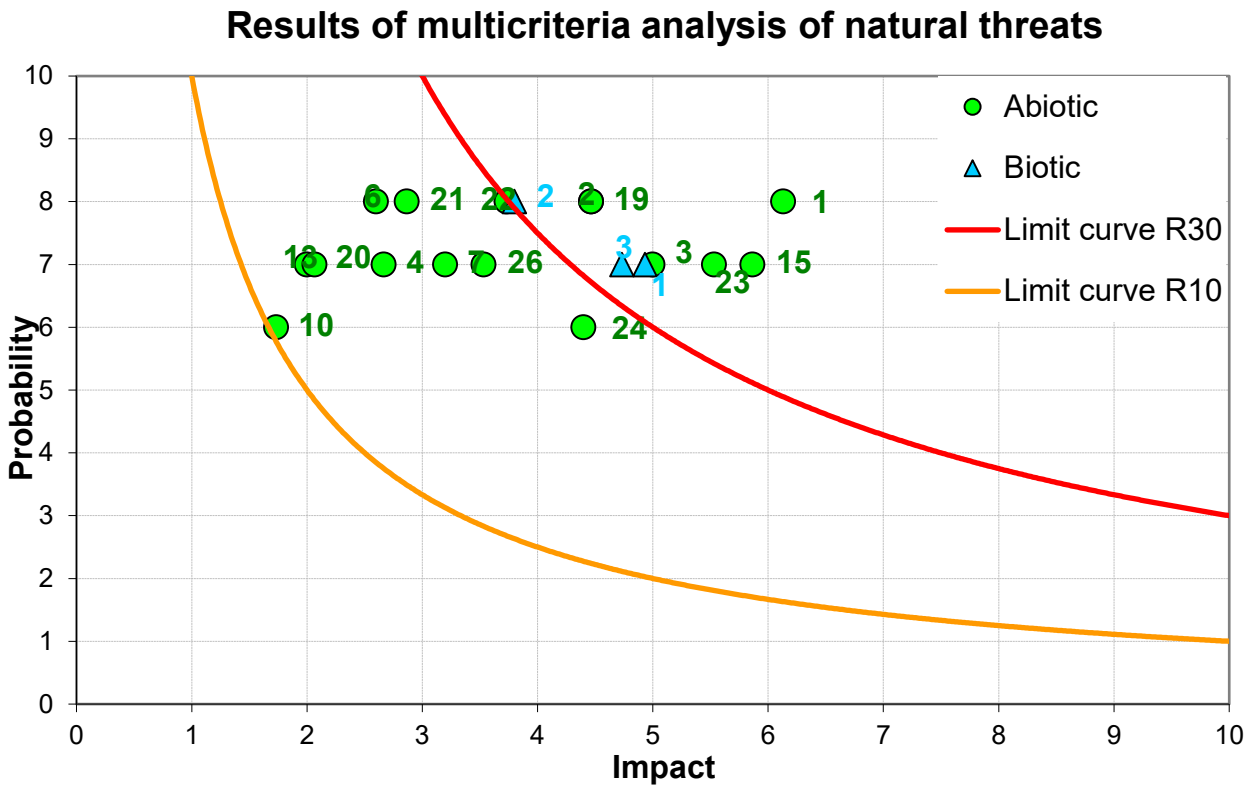
For the purpose of risk evaluation, limit values of the risk level were determined and three basic categories were defined:

- acceptable risk (level 0-10)
- conditionally acceptable risk (level 11-29) and
- unacceptable risk (level 30 and higher)

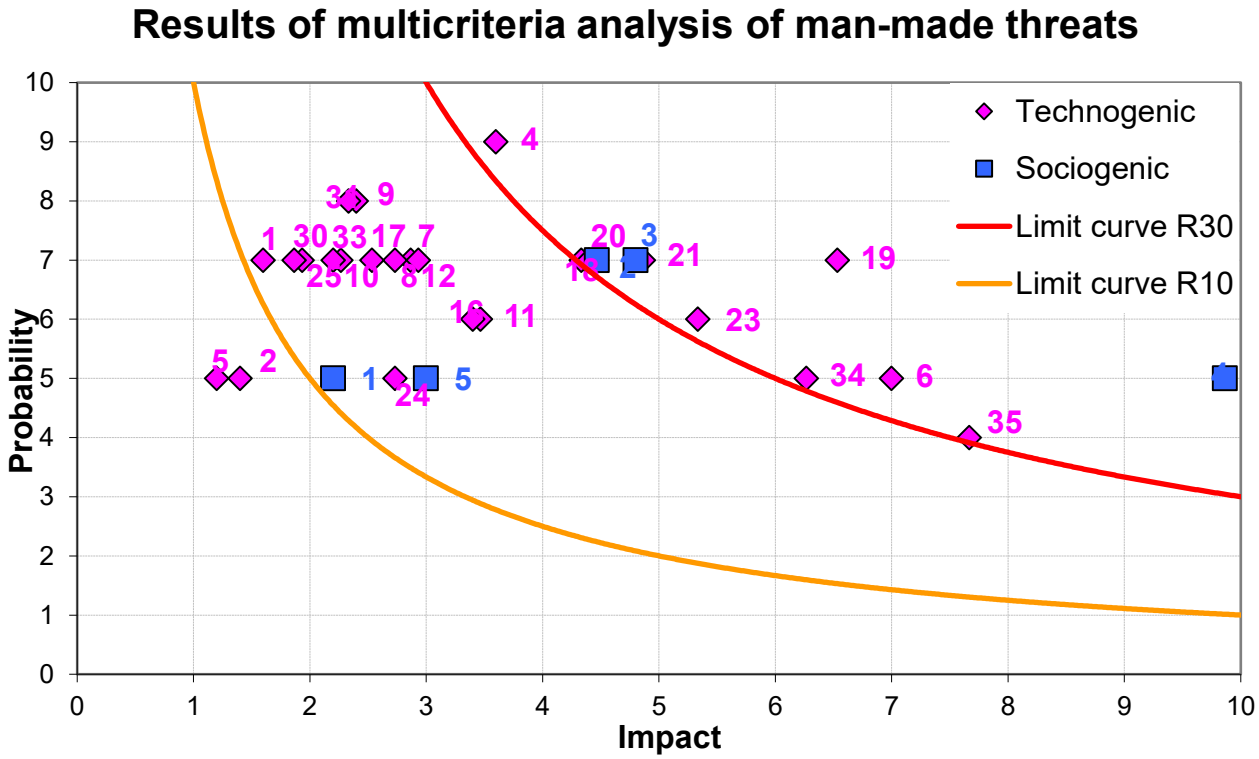
Acceptable risks can be dealt with through usual activities of the authorities and security services; the adoption of special measures is not expected (e.g. hail, snow avalanche, mining disaster). Conditionally acceptable risks do require the adoption of some special measures. This category includes e.g. wildfires, major air traffic accident, or explosion in the ammunition and explosives repository. Dealing with emergencies included in the category of unacceptable risks generally requires adopting crisis measures stemming from the Crisis Management Act and it claims the highest priority of all the levels of public administration. These risks are so serious that the authorities on all levels have to compile preparedness plans for them. This category includes e.g. flood, epidemics, or large-scale migration wave.

[3] This document is available on the DG FRS webpage: www.hzscr.cz/hasicien/article/crisis-management-in-the-czech-republic

For easier comprehension, the identified risks were projected on a matrix with the risk levels marked. Picture 2 and Picture 3 below illustrate the risk assessment results of natural and man-made risks, with both limit curves depicting the acceptable (<10), conditionally acceptable (11 and 29), and unacceptable (>30) risks being displayed in orange and red respectively.



Picture 2: Natural risks displayed in a matrix



Picture 3: Man-made risks displayed in a matrix

1.2. Risk Assessment Results

A total number of 72 types of risks were identified; using these, the basic risk registry was created. Man-made risks represented 54 %, natural risks 46 % of the whole. From the total 72 types of risks:

- 21 risks were designated as low-level risks and therefore have not been further investigated,
- 2 risks were automatically classified as high-level risks because it is clear that if such an emergency were to happen, the state of crisis would have to be declared (Disruption of information security of critical information infrastructure and Large-scale disruption of financial and foreign exchange management of the state),
- 49 risks were further investigated.

On these 49 risks, a detailed risk analysis was performed and the results evaluated. Risks with an acceptable level of hazard represented 4 %, risks with a conditionally acceptable level of hazard 53 %, and risks with an unacceptable level of hazard 43 % of these. In the end, a total of 21 types of unacceptable risks were identified. However, the risk of a military attack on the country was excluded from the final list because external threats are dealt with in the scope of the existing separate system of defence planning. When we add the two risks identified as high-level risks beforehand, in total 22 types of risks, for which the declaration of a state of crisis can be expected, were identified. For each of these, a model action plan has to be compiled by the responsible authority and later periodically updated. These plans describe recommended procedures and measures to address the specific type of emergency and are later elaborated in the crisis plans of regions and authorities. Below, find Table 1 displaying a list of unacceptable risks.

	TYPES OF THREATS WITH UNACCEPTABLE RISK	RESPONSIBILITY
natural	Long term drought	**MoE,** MoA, MoI
	Extremely high temperatures	**MoE**
	Flash flood	**MoE**, MoI, MoA
	Heavy rainfall	**MoE**, MoI
	Extremely strong wind	**MoE**, MoI
	Flood	**MoE**, MoI, MoA
	Epidemics – human disease outbreak	**MoH**
	Epiphytic – plant disease outbreak	**MoA**
	Epizootic – animal disease outbreak	**MoA**
man-made	Large-scale disruption of food supply	**MoA,** MoIaT
	Disruption of function of an important electronic communication system	**CTO**, MoIaT
	Disruption of information security of critical information infrastructure	**NSA**, MoI
	Special flood	**MoA**, MoI, MoE
	Dangerous chemical substance leakage from a stationary facility	**MoE**, MoI, SOfNS
	Large-scale disruption of drinking water supply	**MoA**
	Large-scale disruption of gas supply	**MoIaT**, MoI
	Large-scale disruption of oil and oil products supply	**AoSMR**, MoIaT
	Radiation accident	**SOfNS**, MoI
	Large-scale disruption of electricity supply (blackout)	**MoIaT**, MoI
	Large-scale migration waves	**MoI**, MFA
	Large-scale disruption of the rule of law (incl. terrorism)	**MoI**

	Large-scale disruption of financial and foreign exchange management of the state	**MoF,** CNB

Table 1: List of the unacceptable identified risks

1.3. Identifying the key risks at a regional level

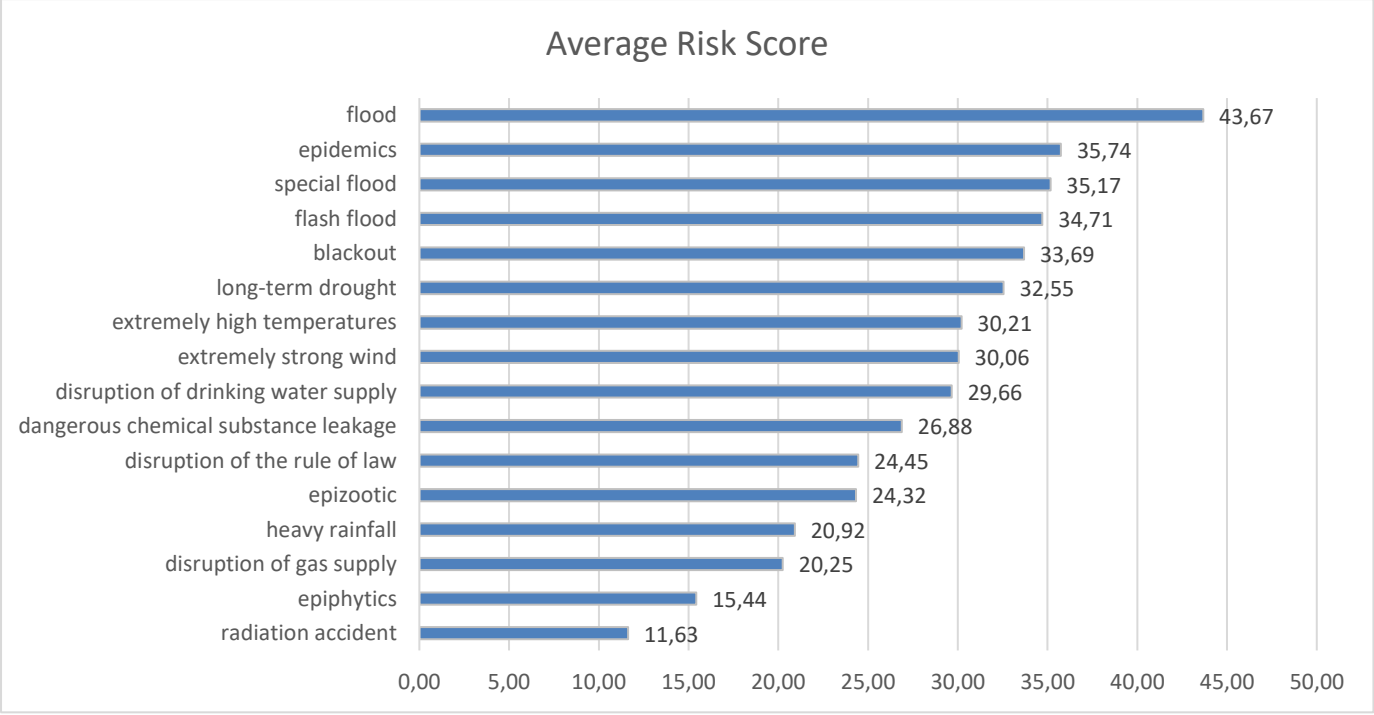
Next to the national level, separate risk analyses, albeit on grounds of the same methodology and risk register, were also performed in all the 14 administrative regions of the Czech Republic. The results of these analyses, evaluated and statistically summarized, are the starting point for crisis plans of the regions compiled by the regional FRS with only relevant risks being elaborated in detail.

The most commonly identified risk in the regions was the flood, identified in all the regions without exception, with the average risk score of 43,67 (the highest value of 54,40 was in the region where the largest Czech river the Elbe flows out of the Czech Republic). The second highest risk score value had epidemics, 35,74, and third special flood with 35,17.

Some risks are "not applicable" for the regional level because they need to be coordinated and resolved from the central level. Among these are the Disruption of information security of critical information infrastructure, Disruption of the function of an important electronic communication system, Large-scale disruption of food supply, and Large-scale disruption of financial and foreign exchange management of the state. It would not be reasonable trying to deal with such a situation from a regional level, although the regional governors and crisis staffs would be of course informed about all the measures adopted by a central level in detail. A special case is the epiphytic - it is a possibility in all the regions, but the average risk score was 15,44, therefore the regions don't plan for this emergency; the preparation lies solely in the hands of central administrative authorities.

An interesting statistical anomaly is the radiation accident; if the nearest nuclear power plant is two hundred kilometres away, it is not necessary to plan a set of regional crisis measures. On the other hand, for the regions with the contingency planning zone of such a facility, it is of utmost importance to plan in detail for this type of emergency. The average risk score for radiation accident was therefore very low: 11,63 (the lowest average score of all the threats having scored above 30 in the national risk assessment) with three regions (where the contingency planning zones are) having a score of above 30 (the highest value being 38,33). Three further regions positioned nearer to the nuclear facilities had scores of 10-25,33 and all the other regions evaluated this risk to 0,00.

The diagram below shows the average risk score for relevant unacceptable threats on the regional level.



Picture 4: Average risk score for unacceptable threats identified in the regions.

1.4. Risk mapping

Risk mapping is a process of risk classification and quantification in relationship to a certain territory by the interaction of different types of threat with the vulnerability of territory and preparedness of this territory. Risk map visualizes the scale of expected losses and damages expected in a certain area and it also allows to identify the composition and extent of risk for each part of the analysed territory.

Since 1 October 2018, the project "Risk Mapping for Territory of the Czech Republic 2018-2021" has been financed by MoI and developed under the auspices of VSB – Technical University of Ostrava. The project is focused on the elaboration of Risk Analysis for the Czech Republic. Its objective is to create a certified methodology, a software tool for performing calculations according to this methodology, and a web application for end-users that enables risk maps visualisation and working with these maps. Information from the risk map will be used particularly in the process of crisis and emergency planning, for optimisation of the population warning system, allocation of IRS forces and resources, in spatial planning, etc. This information can be also provided to the population and business entities.

The methodology will set the procedure of risk mapping on a basis of defining characteristics of the territory. It will contain the description of algorithms of calculations with the usage of mathematical models during risk mapping and also specific types of threat to be included into the risk mapping the same way as elements of territorial vulnerability and elements of preparedness on the territory which have to be considered during the risk map processing. Consequently, the methodology will be implemented into a desktop application used for calculation from available spatial data. The subsequent web application will enable navigation in map data and it will help to get a complex overview of the composition and type of risk on a certain territory. The web application will be used by central administrative authorities and also crisis management authorities on the regional level.
At the time of the creation of this document, the preparation of source data has been finalized as well as testing of calculations in the GIS and the web application. The results of the project should be available in 2021.

1.5. Communicating risk assessment results

The results of the national risk analysis are disseminated among the professional public via scientific magazines and publications, seminars, and conference presentations; risk analysis is still an integral part of complex scientific topics and discussions even now, five years after its last major change. Additionally, the summarizing document Risk Analysis for the Czech Republic is publicly available to download from the website of the FRS. The broad public can acquire basic information about the risks in general in the scope of educational activities performed on different levels aiming predominantly at children and senior citizens, in popular scientific literature, leaflets, web pages of specific authorities, and from other sources. In this case, the process of disseminating information case is closely connected to communicating the planned measures aimed at dealing with the possible emergencies. Based on the Crisis Management Act, the public has also the right to receive information from their local authority about possible risks in the area and relevant counter-measures.

1.6. Monitoring and reviewing the risk assessment

The Czech crisis management authorities continuously monitor the risk landscape and critically assess all the events that may lead to possible changes on both the national and regional levels. Should the need arise, the risk analysis would be updated without undue delay to include any major developments. Additionally, the crisis plans where the risks are practically elaborated are also periodically reviewed and necessary changes are being incorporated.
DG FRS repeatedly performed a targeted reassessment of the above-described risk analysis (last time in the summer of 2020) and critically re-evaluated all the risks based on the current experience and information. The conclusion stemming from this process is that the list of all the major risks identified and analysed in 2015 remains unchanged. Similarly, all the authorities responsible for the individual risks, planning for their occurrence, and dealing with the potential emergency remain the same. This was partly verified during the (still on-going) Covid-19 crisis; epidemic was identified as one of the risks on both national and regional levels, the authorities appointed to solve the emergency in the specific model action plan were also identified correctly.
Furthermore, the crisis has shown that the crisis planning system in the Czech Republic is properly set up and aimed in the right direction. The new Methodology on the elaboration of the model action plans developed by the FRS in 2016 emphasises practical measures and practical aspects of dealing with the emergency and accentuates the need for common knowledge of all the crisis management bodies about the planned

measures. In this way, all the authorities know what measures they have to elaborate in their crisis plans; the other authorities have this knowledge too, as well as the authority responsible for solving the specific type of the situation. The result is the focus on a practical solution of the emergency and better predictability. The model action plan on epidemics was provisionally revised in June 2020 to reflect the first experiences with the Covid-19 emergency and to enable more effective dealing with the situation. After the end of the epidemics, the plan will be revised once more and all the lessons learned will be incorporated in the document, as well as the crisis plans of all the relevant authorities.

Furthermore, the Czech Republic realises the dangers related to climate change and the natural threats getting more extreme and less predictable every year. Therefore, all the activities performed in the scope of the process of risk monitoring, reassessment, and re-evaluation are carried out with the climate change implications in mind and in the context of the changing risk landscape. One of the good examples is the risk of long-term drought newly identified in 2015 and its correlation with still frequent floods on the territory of the Czech Republic. Even though these two risks may seem divergent and unrelated, the opposite is true. Ultimately, this has to be reflected in the process of building capabilities necessary to successfully deal with such emergencies.

This whole risk assessment process, although coordinated by the DG FRS, was a joint effort of the specialised task force significantly supported by other authorities on both central and local levels. Many of their representatives attributed with their expertise and knowledge, while others provided valuable commentaries and much-needed opinion opposition. Among the most important contributors were MoI, Police Presidium, MoF, MFA, MoH, MoA, MoJ, MoIaT, MoRD, MoD, MoT, MoE, AoSMR, NSA, SofNS, and CTA. The DG FRS is always prepared to receive their incentives to consider changes in the Risk Analysis.

Part II: Risk Management Capability Assessment

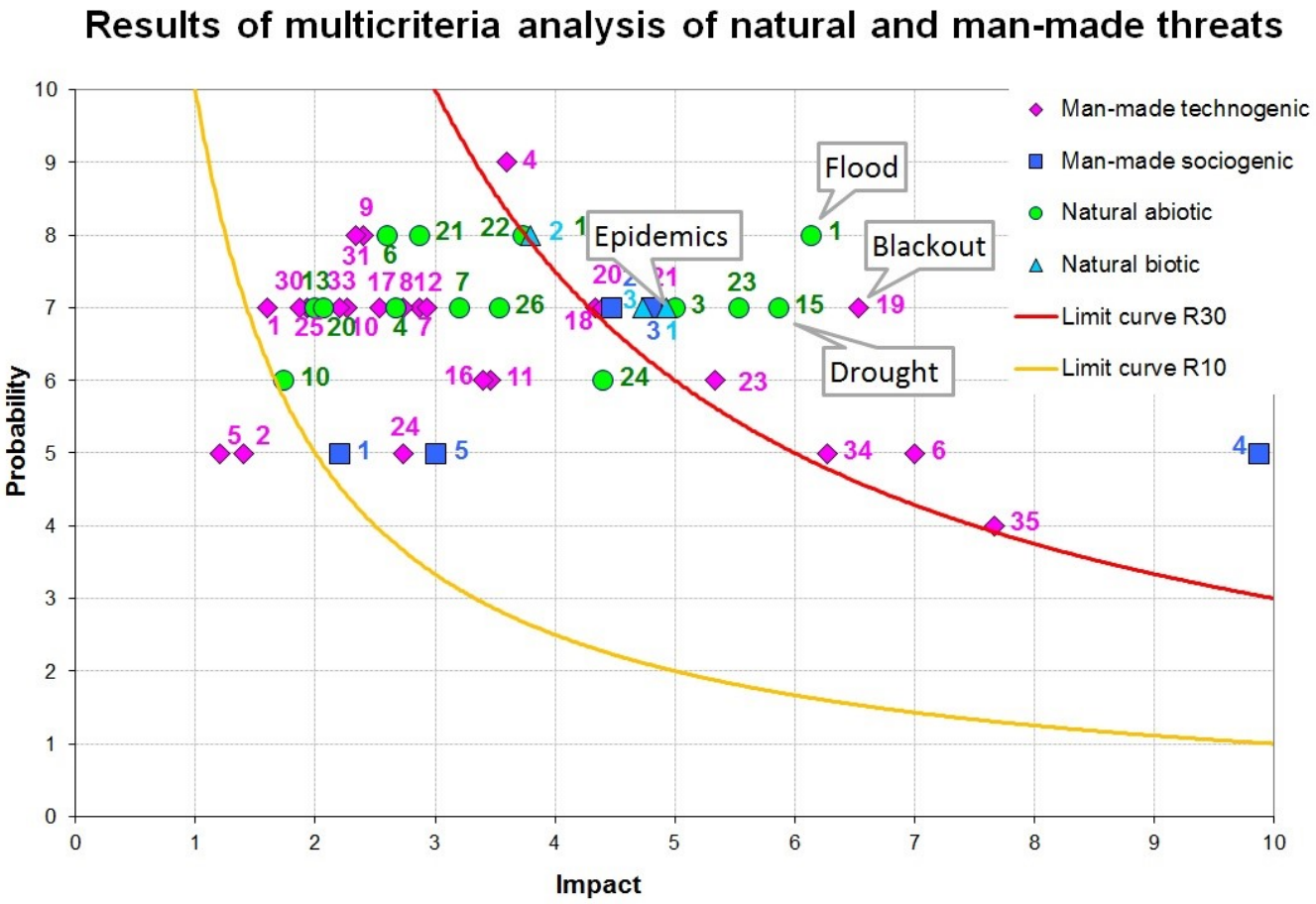
Because of the changing risk landscape, climate change, globalisation, and new challenges, the number of both natural and man-made emergencies grows continuously, and the severity of their consequences is steadily increasing. As preventing these risks or decreasing their occurrence is often impossible, it is imperative for the Czech Republic to be prepared as well as possible to be able to deal with the situation, mitigate its consequences and secure the rapid and successful recovery of the state and societal functions. Only in this manner, it is possible to increase the protection of the population. To achieve this, an integrated approach combining preventive, risk reduction, preparedness, and response measures must be implemented to maximize the chances of successful emergency management. The aim of this report is to identify the individual risk management capabilities, briefly describe and assess them.

As a result of the risk assessment (see Part I), 22 types of risks were identified, where the declaration of the state of crisis in case of their occurrence can be reasonably expected. Because it would seriously overreach the purpose of this document to study, evaluate, and describe all of these 22 risks in detail, a criterion was chosen to select the most important ones for a comprehensive analysis. This criterion was the assigned risk level value. The basis risk level for the „unacceptable“ risks was set to 30, nevertheless, the risk levels of three threats went distinctively above this boundary, reaching the values of ≥40, giving them a status of so-called supercritical risks. Among these risks that were thoroughly studied are the following:

- Flood (risk score of 49,07),
- Long-term drought (risk score of 41,07),
- Large-scale disruption of electricity supply (hereinafter referred to as “blackout”; risk score of 45,73).

Furthermore, on a basis of the current world-wide crisis situation and the very contemporary experience of the Czech Republic, we decided to add one more threat to this evaluation – epidemics; even though it has the risk score of „only“ 34,53. The year 2020 has clearly shown that even the threats perceived as „serious, but not critical“ can have unimaginably grave consequences for the functioning of both countries and their citizens and it is of utmost importance to share all the available knowledge, processes, and best practices. Even though the Czech Republic was fairly well prepared for the case of epidemics, serious gaps were discovered, resulting from the world-wide nature of the pandemics. We intend to use the newly acquired experience to adapt to the emergency management system of the Czech Republic (with a particular focus on dealing with epidemics) to make it more capable, robust, and resilient.

The position of these selected supercritical risks and epidemics in relation to the other risks is displayed in the following picture.



Picture 4: Position of flood, long-term drought, blackout, and epidemics in the risk matrix

It is not the aim of this report to exhaustively describe all the details of capabilities for managing these four risks, but to indicatively outline key information and to discuss both the strong and weak points of its setting. To better structure their description and to concentrate on the most important aspects of the risk management capability, we decided to focus on three defining aspects, namely: technical, financial, and administrative. Technical aspects deal with the technical provisions (especially available forces, equipment, and material) and organisational provisions (e.g. expert bodies). The financial aspects are about monetary resources necessary for the capability to be functioning, both budgetary and non-budgetary. Finally, the administrative aspects are described, forming a source of delineated procedures both non-legislative and stemming from laws (e.g. planning procedures). All these characteristics are assessed during their implementation at each stage of the risk management cycle (risk assessment, risk management planning, and risk prevention measures).
Furthermore, we also supply some details on population informing, warning, preparing, and raising their awareness as well as education of both public and experts.

2.1. Flood

Flood means a temporary substantial increase in the level of watercourses or other surface waters, during which water already floods the area outside the watercourse bed and may cause damage. Floods are caused by torrential or persistent rains (summer floods), ice phenomena or melting snow over a larger area (winter and spring floods). Floods result in loss of life, health, property and the environment. Floods can also cause other combined crises (e.g. large-scale contamination of the area caused by the release of hazardous substances). Other impacts of floods include threats to water sources, both surface and groundwater (the cause is the connection of water sources with contaminated flood water and the loss of function of wastewater treatment plants). The accompanying phenomenon of floods is damage to agricultural crops in large areas.
In the conditions of the Czech Republic, floods are the most important and the most frequent natural disaster. A total of 8 major floods have occurred in the Czech Republic since 2000, the last in 2013. A state of crisis was declared during the following floods:

YEAR	NUMBER OF VICTIMS	PROPERTY DAMAGE (billions CZK)
2002	19	73,1
2006	9	6
2009	15	8,5
2010 (May, June)	4	5,2
2010 (August)	6	10,2
2013	15	16,5

Table 2: the overview of major floods in the Czech Republic in last years

Thanks to its rugged territory, the Czech Republic has a dense hydrographic network with a length of about 85.000 kilometres. For the occurrence of floods in the territory of the Czech Republic, the hydrological causal phenomena are decisive. Floods coming from abroad are possible only in case of rivers Ohře, Lužnice, Dyje and Stěnava, and to a lesser extent.
More than 30% of the state borders of the Czech Republic are marked by watercourses. The watercourses that cross the state borders flow out of the vast majority to neighbouring states (i.e. to Germany, Poland, Austria and Slovakia). The Czech Republic's cooperation on transboundary waters with neighbouring states is determined by bilateral interstate agreements. Their fulfilment is usually ensured by commissions for water management issues. The cooperation on border waters is focused mainly on:

- modifications and maintenance of border watercourses, including the construction and operation of facilities on these watercourses,
- protection of transboundary waters against pollution (including observation, monitoring of transboundary water quality, data exchange and organizing of an emergency warning service),
- hydrology and flood alert service (including monitoring, common measurements, data exchange and organizing of an emergency warning service in the case of floods, ice events and more),
- protection of water resources for water supply.

Within the framework of international commissions, MoE and MoA cooperate on the elaboration of international river basin plans, international flood risk management plans and a set of flood risk management plans coordinated at the level of the international river basin district. The territory of the Czech Republic belongs to three international river basin districts - the Elbe, the Odra and the Danube. In addition to international river basin plans, there are also National River Basin Plans, setting targets for the protection and improvement of the quality of surface water and groundwater and aquatic ecosystems, for reducing the adverse effects of floods and drought, for surface water and groundwater management and the sustainable use of such waters for water services and for improving water conditions and protect the ecological stability of the landscape.
Dealing with floods is supported by laws and non-legislative documents. In addition to the Water Act[4], the Act on the Integrated Rescue System[5], the Crisis Management Act[6] and the Act on Public Health Protection[7] are also important. There are also further important regulations such as the Decree on technical safety supervision of water works[8] or the Decree on the manner and extent of preparation of a proposal and establishing of flood territories.[9] The Water Act defines the basic aspects of flood protection and addresses the conceptual and operational level of flood planning. Based on the experience from the floods of 2013, the currently prepared amendment to the Water Act (see chapter on drought) also regulates the flood management, within which the competencies between crisis staffs and flood committees are settled.
The extent, frequency and type of measures adopted in accordance with the applicable legislation is decided based on the intensity of the flood risk expressed through the degrees of flood activity:

- 1st degree - state of vigilance - arises when there is a danger of natural flood and ends if the causes of such danger disappear,
- 2nd degree - state of alert - is declared when the danger of natural flood grows into a flood, but there is no major spillage and damage outside the riverbed,

[4] Act no. 254/2001 Coll., on Waters and amendments to some acts (the Water Act)
[5] Act No. 239/2000 Coll. , on the Integrated Rescue System and on amendment of certain codes
[6] Act No. 240/2000 Coll., on Crisis Management and amending certain acts (Crisis Act), as amended
[7] Act No. 258/2000 Coll., on Protection of Public Health and amendment to some related acts
[8] Decree No. 471/2001 Coll., on technical safety supervision of water works
[9] Decree No. 236/2002 Coll., on the manner and extent of preparation of a proposal and establishing of flood territories

- 3rd degree - state of endangerment - is declared in case of immediate danger or occurrence of large-scale damage, threat to lives and property in the flood territories.

The level of flood risk is determined by the pre-set limits, which are usually water levels or flows in reporting profiles on watercourses. The reporting profiles are located in water measurement stations, which have stabilized water meter profile, a water meter lath and usually also an automatic station with data transmission and a measuring flow curve.
The flood itself begins with the declaration of the second or third degree of flood activity. The flood forecast service informs the flood authorities about the flood danger, when the flood begins and about further dangerous development. The Flood Reporting Service provides information to flood authorities to warn the population in the area of the expected flood and in places down the watercourse, informs flood authorities and similar actors about the development of the flood situation. The Flood Reporting Service also conveys the news and the reports necessary for the evaluation of the flood situation and the management of the flood protection measures.
Flood authorities ensure the management of flood protection. During the flood, the flood authorities are: flood committees of municipalities, regions and the central flood committee. Flood committees are established by state administration and self-government bodies as their executive bodies to perform specific tasks during floods (municipalities set up flood committees only if there is a real risk of flood in their territorial district). At the time of a flood, flood committees are equipped with special powers to take measures and issue operational orders to ensure flood protection. In the period outside of a flood, the flood authorities are: municipal authorities, municipal offices, regional offices and the MoE. The MoI is responsible for ensuring the preparation of rescue works.
The involvement of other participants in flood protection depends on the nature of the flood situation and local conditions. Representatives of the most important entities are usually members of the relevant flood committee. The coordination of measures that could affect flow rates within a specific river basin is ensured by the river basin managers, who have established water management dispatching centres for the purpose of operational management of water systems. As part of their flood protection tasks, river basin managers also prepare expert opinions on flood plans, cooperate on the compilation of flood plans and performing the flood inspections, provide suggestions to flood authorities to perform the necessary provisions in flood territories, participate in flood reporting service, propose the announcement or revocation of degrees of flood activity to flood authorities, provide professional, technical and organizational support for the activities of flood committees, and compile the documentation describing the course of flood in the river basin.
In the scope of their flood protection tasks, the owners of water reservoirs are obliged to carry out flood inspections in cooperation with flood authorities, to monitor all phenomena that could negatively affect the safe flow-through of the flood, to participate in the flood reporting service (informing the flood authorities, watercourse administrator, relevant river basin administrator, CHMI and FRS about the danger and course of the flood), issue directives for the water dam manipulation within the limits of the approved handling regulations to reduce the risk of flood damage.
For the activities of flood authorities, flood plans are very important, which summarize organizational and technical measures to avert or reduce flood damage and, together with emergency and crisis plans, provide support for operational measures.

Among the strategic and conceptual documents dealing with the issue of floods are:

- Model action plan “Flood”, further elaborated in regional crisis plans,
- Strategy for Protection Against Floods in the Czech Republic,
- Concept of Population Protection until 2020 with a View to 2030[10];
- Concept of Environmental Safety for 2016-2020 with a View to 2030[11],
- Concept of Flood Protection in the Czech Republic with the Use of Technical and Nature-Friendly Measures,
- Flood risk management plans of the Czech Republic and National River Basin Management Plans (Elbe, Danube, Odra).

Flood protection is ensured primarily through systematic prevention and operational measures. Preventive measures are mostly of structural nature (construction investments) and it is necessary to ensure their financing. Among these measures are riverbeds adjustments, construction of protective dams, retention

[10] A new concept for the next period is currently being prepared.

[11] The new Concept of environmental safety is planned for the years 2021-2030 with a view to 2050.

tanks and polders, as well as measures to maintain the retention capacity of the landscape and measures in flood territories. In addition to the state administration, a number of other entities also have to participate in the implementation of preventive measures - whether at the level of regions, municipalities or property owners. Effective preventive measures must be applied systemically and it is necessary to use the outputs from modern technologies of mathematical flood modelling. Operational measures, mainly of a non-structural nature, are carried out before, during and after the flood and are coordinated and managed by the flood authorities.

Therefore, preparedness is one of the key principles for dealing with floods. As the occurrence of floods cannot be prevented, it is necessary to predict them as timely and accurately as possible and immediately issue an alert to which the relevant actors have to respond quickly and adequately. This task is performed by the Integrated Warning Service System administered by the CHMI in cooperation with the Meteorological Service of the Army of the Czech Republic.[12] The Flood Information System, which e.g. publishes data to be used in digital flood plans and unifies information about the course of floods, supports the activities of bodies dealing with floods. It also has a digital flood book and digital flood plans at its disposal.

Due to the rapid flood development and the uncertainty of the precise localization, it is necessary to monitor the situation of precipitation development and identify the endangered areas. All available information warning systems can be used (e.g. local alert and warning systems, local radio). If there is a risk of flood occurrence, it is necessary to implement all the available measures to prevent or mitigate the negative consequences. Straight away, it is necessary to commence the preventive evacuation of people from endangered areas and to restrict their movement in the endangered areas.

Measures for flood management include: issuing CHMI warnings, carrying out constructions and construction works, terrain adjustments or demolition, implementing measures according to the flood plans, carrying out flood rescue works, special dam water level manipulations, suspension or restriction of water supply, establishment or continuation of patrol service providing reporting, prohibition of entry, stay and movement of persons in the affected area, imposing of work duty and work assistance, prohibition of sailing on rivers and, where appropriate, controlled spills.

With regard to the nature of the territory and the location of the Czech Republic, it is necessary to address flood protection in an international context, especially within the framework of existing international agreements on cooperation in river basins extending beyond national borders.

The Czech Republic has all the necessary material and technical equipment for dealing with the floods, as well as the capacities to provide assistance abroad, inter alia within the Union Civil Protection Mechanism[13]. We can deploy e.g. a module for high-capacity water pumping (equipped by e.g. special large capacity pumps and corresponding logistical and command support) or a module for flood rescue by boats. The executive response forces response are the bodies of the IRS[14]. In addition, municipalities also ensure manpower and material resources, including the procurement of the necessary material equipment for rescue works and the provision of alternative functions in the area.

As part of the preparation for the floods, exercises are regularly held. The aim of these exercises is to practice erecting of mobile flood barriers in cities, to test the correct assembly and disassembly of flood protection components and to check their condition. The speed of flood barriers erection, the efficiency of equipment and cooperation between the IRS bodies is also tested.

Due to the financial demands, ensuring effective protection against floods is a long-term process, with the preference to support prevention over reimbursement of flood damages. Flood protection is one of the public interest priorities, therefore the main financial resources stem from the state budget and EU funds. Other, especially public financial resources supplement the above-mentioned resources. The aim is primarily to finance using EU funds, but it is not possible to finance some measures in this way. For this purpose, complementary national programs were introduced.

Within the second period of the Operational Program Environment for the years 2014 - 2020[15], financial resources are provided for:

- Support of flood prevention measures, such as the setting up and expansion of warning, alert, forecasting and warning systems and digital flood plans,

[12] Issuing the warning information within the IWSS is one of the tasks of the Reporting Flood Service, which the CHMI provides in accordance with the Water Act.

[13] As part of the EU Civil Protection Mechanism, the Czech Republic provided e.g. the assistance to Iran, which was affected by flash floods in April 2019.

[14] For example FRS and fire brigades ensuring area fire protection, Emergency Medical Service, Police, specified forces of armed forces.

[15] Operational Program Environment allow to draw funds from the European Regional Development Fund and the Cohesion Fund for projects in the field of environmental protection.

- Ensuring flood protection in urban areas, e.g. stabilisation and correction of slope instabilities,
- Reduction of the amount of pollution released into surface water and groundwater, e.g. through construction and modernisation of wastewater treatment plants.

The National Environment Program is focused on the priority area "water", which aims to improve the quality of surface water and groundwater and to respond to negative phenomena and impacts of climate change (floods, drought, water scarcity). Additional goals are to support water recovery in the landscape, increase the amount of water supply and their quality and increase the efficiency of the water resources usage. The Czech Republic also supports a number of programs and activities aimed at this topic exclusively from national sources. The supported programs include "Flood Prevention" focused on the implementation of measures to ensure systemic to cities and municipalities protection against floods. These include, in particular, the construction of dry reservoirs (polders), modifications of existing water reservoirs and measures along watercourses in urban areas.
Financial resources from EU structural funds are a crucial source for prevention and preparedness. For example in the programme period 2007-2013, the National Humanitarian Aid Base was built using the funds from the Integrated Regional Program. With the help of the National Humanitarian Aid Base, it is possible to effectively provide needed help and services, not only during floods in the Czech Republic, but also to provide assistance abroad.
Using the structural funds[16], necessary equipment was procured and capabilities for intervention management, rescue works, emergency survival of the population, humanitarian aid and remedy works were reinforced. In order to further develop and increase the preparedness of the Czech Republic to deal with floods, it is necessary to obtain the financial resources for the acquisition of new equipment, technologies and means. In this way, higher operability, better efficiency of interventions and increased mobility of the rescue units during floods will be achieved.
Government-issued bonds may also be used for financing. Tax measures can also be used to produce a direct financial effect (e.g. by introducing a targeted tax) or measures that can be used indirectly through the acknowledgement of tax relief to affected entities.

2.2. Long-term Drought

Drought is a normal, recurring natural phenomenon, but a long-term and intensive drought can have a substantial impact on the ecosystem resulting in crisis situation. It occurs because of a prolonged precipitation deficit period, amplified by above-average temperatures, which leads to a significant decrease of water in the hydrological cycle (atmosphere, soil, watercourses, and underground structures) and subsequently in water sources. If, due to drought, water use requirements exceed the available water resources and it is necessary to reduce water management and take further action, a water scarcity situation arises. Water scarcity has a direct impact on the population of mainly large cities and densely populated areas. Changes in water availability and quality will also affect agriculture, industry, transport and tourism. Drought and lack of water also increase the risk of fires, their spread and cause damage to forests and fields. The resilience of the area to drought depends on the use of the landscape, the state of the surface water and groundwater reserves, water infrastructure and water consumption. Dry episodes can last for months or years.

The authorities responsible for coordinating measures to combat drought are MoE and MoA. The main specialized body is the interdepartmental commission WATER-DROUGHT established in 2014. Its members are MoE, MoA, CHMI, Czech Fire Brigades, Povodí Vltavy (Vltava River Basin company), research organizations and others. The main output of this commission is the Concept for protection against the consequences of drought for the territory of the Czech Republic (approved by the Czech Government in 2017)[17]. The independent expert body in this area is the National Coalition to Fight Drought, which is trying to develop conceptual solutions so that individual drought projects are synergistic and do not overlap.

The Czech Republic is active in the international commissions of all three river basins to which its territory belongs - International Commission for the Protection of the Elbe River, the International Commission for the Protection of the Danube River and the International Commission for the Protection of the Odra River against Pollution. These commissions deal strategically with the issue of drought at international level.

[16] For example the project "Preparedness of the Fire Rescue Service of the Czech Republic to deal with floods".
[17] Other outputs are included in Preparation for the implementation of measures to mitigate the negative impacts of drought and water scarcity.

As part of the activities of these commissions, the Czech Republic participates in the elaboration of joint international plans for the Elbe, Danube and Odra river basins.
The specialized executive unit is the Air Fire Service dedicated exclusively to forest fire fighting (operating since 2017 under the MoA, which also finances it). The Air Fire Service is provided by aircraft of private airlines and helicopters of the Air Service of the Czech Police and follows the Directive for Extinguishing Forest Fires by aeronautical technology from 2019.

The issue of drought has been actively addressed at the national level for several years, but in particular, at the level of concepts and analyses; implementation of the drought issue into the legal order has so far been lacking. This should change after the approval of the amendment to the Water Act, which incorporates the outputs of the Concept of protection against the consequences of drought for the territory of the Czech Republic. In particular, a new chapter "Drought and water scarcity management" appears in the law, the aim of which is to set up crisis management in times of drought and water scarcity in response to climate change adaptation.

This Act newly:

- defines the terms drought and water scarcity,
- lays down the obligation to draw up, manage and discuss drought and water scarcity management plans,
- sets priorities for water uses,
- establishes drought authorities and their composition (Commission for Drought Management),
- provides a drought forecasting service,
- establishes a declaration of a state of emergency (water scarcity) and special powers therefore,
- regulates new offences (e.g. failure to fulfil obligation imposed by a drought commission in case of water scarcity or failure to provide information to the drought authority).

The Drought Management Plan will be an essential tool for drought management. Drought management commissions will be established at central and regional levels. In times of water scarcity, the commissions will be convened to decide on the adoption of defined measures. The superior body of the drought commission will be the MoE or the MoA according to its specific competence. The MoE and the MoA will become bodies for managing drought and the state of water scarcity, and together they will draw up and continuously update a Drought Plan for the Czech Republic.
An important tool in reducing soil erosion, which helps to better retain water in the soil, should also be the currently prepared "anti-erosion" decree on the Agricultural Land Fund Protection Act. Current agricultural practices, combined with climate change, are causing huge soil degradation (21 million tons of topsoil disappear annually due to erosion).

Research and development play an important role in the fight against drought, so one of the important tools is the online prediction system for drought management HAMR (hydrology, agronomy, meteorology and retention). HAMR can predict the development of the hydrological situation up to 8 weeks in advance. The Intersucho portal is dedicated to forecasts and monitoring of drought and its effects in the Czech Republic and Central Europe, where it is possible, for example, to find out the current state of drought and forecasts of drought intensity, including its display on a map.

As part of the fight against drought and the solution of water scarcity, there is also an intention to build new dams in the Czech Republic. Since 2011, there have been 65 localities in the Czech Republic[18] suitable for the possible construction of dam reservoirs, which are protected for the accumulation of surface water. In 2020, another 21 extended the list of these localities[19]. The construction of six new reservoirs is currently being prepared in selected localities, such as Nové Heřminovy, Skalička, Vlachovice, Kryry, Senomaty and

[18] The sites are listed in the document General of areas protected for surface water accumulation and the basic principles of the use of these areas, which was prepared in 2011 by the MoA and the MoE. The obligation to prepare this document is based on the Water Act. The General in question is not a 'plan for the construction of dams', but an important basis for spatial planning. The purpose of the territorial protection of the sites included in General is that these sites can be used in the long term, if necessary, for the construction of water reservoirs.

[19] In recent years, it has become apparent that the 65 sites originally agreed do not provide sufficient sites to ensure the accumulation of surface water, especially in the future for future generations. In 2019, the National Coalition for Combating Drought decided to update the General of areas protected for surface water accumulation and the basic principles of the use of these areas; in 2020, the document was updated and expanded by 21 protected places.

Šanov. The construction of new dams will bring increased demands on financial resources, roughly half a billion CZK must be set aside only for the interconnection of water supply systems, where seven pilot projects are intended to help supply water to one million inhabitants. Between 2022 and 2025, smaller reservoirs should be built in Šanov and Senomaty (in the order of hundreds of millions of CZK). Subsequently, the construction of larger reservoirs should begin: in 2025, the water reservoir in Heřminovy (assumed 2,5 billion CZK)[20]; in 2026 the water reservoir in Vlachovice (assumed 5,5 billion CZK); in 2028 the water reservoir in Skalička (assumed 3,8 billion CZK) and in 2034 the water reservoir in Kryry (assumed 1,7 billion CZK). In the dry season, the reservoirs can increase the flow of rivers below them, helping both plants and animals and, for example, water-dependent industries. Maintaining the flow also helps to dilute the water coming out of wastewater treatment plants. At the same time, the dams can retain water during floods and thus protect the inhabitants.

The basic conceptual document in the field of drought management is the Concept of protection against the consequences of drought for the territory of the Czech Republic. This Concept forms a strategic framework for the adoption of effective legislative, organizational, technical, economic and other measures to minimize the impact of drought and water scarcity on the lives and health of the population, economy, environment and the quality of life in the Czech Republic. The Concept includes all aspects of drought that the Czech Republic may face in the near to medium distant future. As a result of fulfilling the assigned tasks, the Czech Republic should be resistant to dangerous manifestations of drought and water scarcity.

The concept sets out strategic objectives for dealing with drought, which are:

- raising awareness of drought risk through monitoring and prediction of drought, ensuring preparedness through drought management plans and general education,
- the balance between water resources and the water demand across sectors,
- mitigating the effects of drought by restoring the natural water regime of the landscape.

Meeting these objectives requires the implementation of a number of measures:

- Creation of an information platform on drought and water scarcity, which provides information on the current state of drought and water resources, including expected development,
- Strengthening the resilience and development of water resources (improving the water infrastructure, protecting the quantity and quality of available water resources, building new water resources, developing agricultural irrigation, improving fire protection),
- Agriculture as a tool for water quantity and quality protection and soil protection - measures responding to the deteriorating irrigation balance, declining retention capacity of agricultural land, the effects of water erosion and water pollution. The aim is to reduce the effects of drought in agriculture, improve the physical properties of soils, slow down the outflow of water from the landscape and protect water quality,
- Increasing the retention and accumulation capacity of the landscape - correction of landscape drainage and human interventions in the network of watercourses. The aim is to retain water in the landscape and increase the resilience of aquatic ecosystems to hydrological extremes,
- Promoting the principles of responsible water management across sectors - reducing water demand, its reuse and reducing water pollution.

The process of fulfilling these measures is evaluated annually by the submitted Position report on progress in implementing the Concept of protection against the consequences of drought for the territory of the Czech Republic.

Other important conceptual documents in this area are:

- The State Environmental Policy of the Czech Republic 2012 - 2020, which defines the plan for the implementation of effective environmental protection in the Czech Republic by 2020. The newly prepared state policy is planned for 2030 with a view to 2050.
- Strategy for Adaptation to Climate Change in the Conditions of the Czech Republic for the Years 2015 - 2020 with a View to 2030, which summarizes the observed climate change at the global, European and national level and presents prepared projections of further climate development and expected impacts on the territory of the Czech Republic. This strategy was implemented by

[20] The state has already bought 99% of the land needed for construction.

the National Action Plan for Adaptation to Climate Change. These documents are currently being updated.

- The Concept of Environmental Safety for the Period 2016 - 2020 with a View to 2030; the aim is to reduce the emergence of crisis situations caused by the interaction of the environment and society. The new Concept of Environmental Safety for the years 2021-2030 with a view to 2050 is currently being updated and approved.
- Strategy of the Ministry of Agriculture until 2030, which defines, among other things, the strategy of water management and sustainable care of water resources. It is further elaborated in the Implementation Plan.

The financing of drought protection mainly takes the form of support for improving the landscape's ability to accumulate water, more efficient use of drinking and rainwater in municipalities and households, and protection of water resources. In the coming years, securing assistance from European funds is crucial for financing drought protection.
The MoA prepared a set of 12 long-term subsidy programs for the implementation of technical measures for drought protection by 2033 in the total amount of 17.88 billion CZK; the source is the state budget and investors' own resources. These include support for water retention in the landscape (ponds and water reservoirs), measures on small watercourses and small water reservoirs, support for the competitiveness of the agro-food industry - irrigation, support for the construction and reconstruction of water supply and sewerage infrastructure.
Through the Operational Program for the Environment, it is possible to draw funds from the European Regional Development Fund and the Cohesion Fund for projects in the field of environmental protection. The National Environment Program has been created in the Czech Republic, which is designed as a supplementary program for projects that are not supported under the Operational Program Environment. These programs support anti-drought measures (e.g. the creation and restoration of ponds, wetlands and small water reservoirs, grass strips to slow down water run-off, the establishment of greenery in municipalities, but also the improvement of water infrastructure, projects to expand water supply networks, the construction and reconstruction of drinking water sources and others to ensure quality drinking water for citizens). Sustainable water management (e.g. rainwater capture, construction of domestic wastewater treatment plants, reduction of pollution of discharged wastewater and others) is also encouraged. Support for environmental projects will continue through the Operational Program Environment in the period 2021-2027. The program will be divided into several thematic areas, including in particular adaptation to climate change (support for measures to prevent and adapt to droughts, floods and landslides).
In addition, the Rural Development Program of the Czech Republic also includes support aimed at improving the moisture balance of the soil and the retention and use of rainwater. Funds intended to combat drought are also allocated in the budgets of regions and municipalities.
In other subsidy titles, the MoE also supports measures that help mitigate the negative effects of drought and water scarcity. In particular, these are the Support for the Restoration of Natural Landscape Functions program and the Landscape Care Program.
Since 2015, 7.4 billion CZK has been spent on measures against drought and water scarcity under long-term subsidy programs from the state budget and 21.6 billion CZK from European Union resources.

2.3. Blackout

The electrical grid is an area system with a high degree of interconnection to the electrical grids of the surrounding states, which is sensitive to the correct function and required interaction of its individual elements. Due to the fact that electricity cannot be stored in significant quantities, the balance between production and consumption must be constantly maintained. The electrical grid as a whole must continuously meet the requirements for securing the changing amount of electricity consumption. There are events which, depending on their severity, the extent of the territory in which they operate and the frequency of occurrence, can cause damage or loss of function of one or more elements and can lead to accidents of a regional or national level.

If the cause of the outage is a minor fault, the outage is short-term and the electrical grid can be recovered within six hours or shorter time (usually a local outage). In this case, it is usually not necessary to declare any crisis measures. Supply disruption caused by overload, voltage collapse, human factors, etc. is usually medium-term (up to 18 hours); outage caused by natural influences or as a result of a terrorist attack (and thus involving significant damage to physical infrastructure) usually means recovery taking several days up to weeks and in such case, special measures would be required.

If the entire transmission system or a significant area of the electrical grid is de-energized, a so-called blackout occurs, which can be characterized as a large scale power outage for a large number of population for tens of hours or several days. When this situation occurs, it is necessary to declare a special state and implement special measures. The interconnection of electricity grids of individual states and their synchronous operation can cause easy spreading of crisis situations from neighboring countries to the Czech Republic and vice versa. In the event of a blackout, it must be taken account that the ability of Czech Republic to fulfill its international allied commitment, contractual or trade obligations can be limited.

At the same time, the risk of blackout in the Czech Republic can be caused by external influences; specifically massive unplanned flows of electricity from northern Germany, that have to be balanced out by the operators in the Czech Republic which have to take costly measures to maintain the reliability of the network and electricity supply. In addition, these flows have a negative impact on international electricity trade because part of the cross-border transmission capacity needs to be reserved in the event of unplanned flows from Germany. For this reason, in 2012 the MoIaT decided to build phase shifting transformers. The construction began in 2015 and the total cost for the entire construction, including the acquisition of four phase shifting transformers, was estimated to 1.6 billion CZK. The operator of these transformers, Czech company ČEPS, installed them in two stages in January and September 2017. The transformers are located in an electrical substation in Hradec u Kadaně. Due to this investment, ČEPS dispatchers can regulate electricity flows and keep them within safe limits.

The threat of blackout is addressed by Act No. 458/2000 Coll., on business conditions and the functioning of state administration in the energy sectors. It defines the state of emergency in the electricity sector, the conditions of its declaration and how to prevent it. The details concerning this state of emergency are defined in the implementing decree[21] to the abovementioned Act.
The state of emergency in the electricity sector is defined as a state that occur in the electricity grid as a result of natural disasters, accidents, accumulation of faults in electricity generation, transmission and distribution facilities, terrorist attacks, electricity grid imbalance or failure overflow from a foreign electricity grid, and which causes a significant and sudden shortage of electricity or endangers the integrity of the electricity grid, its safety and reliability in the entire territory of the state or its part. Prevention of state of emergency in the electricity sector is a set of measures and activities performed by the transmission system operator and the distribution system operator in situations with significant risk of state of emergency occurrence.
Most measures focus on a situation when blackout has already occurred and aim to mitigate its consequences and ensure basic living needs of the population. Ensuring the resilience of the electricity grid and its recovery to operational condition after a disruption is the responsibility of its operators and the state authorities intervene minimally.

The transmission system operator may limit or interrupt the supply of electricity to customers and change or interrupt the supply of electricity from power plants, the import of electricity from abroad or its export. To prevent the state of emergency, electricity consumption is restricted and electricity supply is changed either automatically based on the frequency plan, by technical dispatching of the relevant grid operator or by manual reduction of the supplied power. The power restriction usually follows within one hour after the announcement about the implementation of the relevant regulatory degree. Under these conditions, the right for compensation for caused damage and lost profits caused by restriction or interruption of electricity supply is excluded.

During the state of emergency, the transmission system operator, distribution system operator and electricity producer proceed according to the shutdown plan (manual disconnection or subsequent re-connection of customers by the technical dispatching center), frequency plan (automatic interventions with the objective to reduce major system failures) and emergency plan. The transmission system operator is obliged to announce the emergence and termination of a state of emergency and its prevention in the mass media. A state of emergency is usually declared and revoked in advance. However, in the event of a rapid breakdown of the electricity grid, the state of emergency can be declared subsequently. At the same time, the transmission system operator coordinates the removal of consequences caused by the state of emergency, following the emergency plan. Critical infrastructures are supplied with electricity as a matter of priority; therefore, they are not included in the regulation or shutdown plans of the transmission system operator or they are included among the components of the system for which the period of electricity supply restriction is to be as short as possible. If the supply of electricity to critical infrastructures and priority

[21] Decree no. 80/2010 Coll., on the state of emergency in the electricity sector and on the content of the emergency plan.

customers is not possible, the only solution is the use of substitute sources of electricity (for example backup generators).

The central administrative authority responsible for the area of electricity is MoIaT, ensuring also fulfilling of obligations based on international agreements or membership in international organizations. In cooperation with the MoF, MoIaT also provides financial support for the recovery of infrastructure of energy line constructions operators and it coordinates the re-connection of priority customers during the recovery of electricity supplies in the affected area.
The regional authorities in cooperation with distribution system operators assess the large scale supply disruptions and identify the expected impact of the outage and also implement declared crisis measures. Municipalities implement crisis measures within their territory. The mayor of the municipality informs the population about the ongoing crisis situation and the implemented crisis measures in the territory of the municipality.

In terms of financing, no funds from the state budget have been assigned to preventive activities in this area. Most preventive activities are aimed at strengthening the electricity network and increasing the operational capabilities of the electricity system operators so that the monitoring of the distribution network and effective interventions to eliminate emergencies are ensured. These costs are covered by the budgets of the operators and other private entities. The state budget for blackout preparedness consists mainly of funds for holding of exercises (mainly at the regional level) and for the purchase of backup generators and related building modifications. Portion of the funds reserved for the AoSMR for equipment purchases can be also used for purchases in this area. There are also funds that regions and municipalities set aside in their budgets for their preparation for crisis situations and their resolution.

The Czech Republic follows the "all-hazards approach"; specific chapter of the state budget (regions, municipalities) for preparedness and resolution of crisis situations is therefore not divided according to individual threats, but it covers relevant expenses regardless of the type of threat or crisis situation.
In the event of crisis situations and emergencies, the AoSMR has acquired mobile backup generators of various output (in the second half of 2020, AoSMR had at its disposal 132 backup generators with the output from 3kVA to 200kVA and 3 container generators with the output of 400kVA), which are ready for use in case of extensive power outages.

MoIaT compiled a model action plan for "Large-scale disruption of electricity supply", which assesses individual aspects of blackout in general and lists measures at the national and regional levels which would be used in this type of situation. The measures are further elaborated in the crisis plans of central administrative authorities and crisis plans of regions and municipalities, as well as in the crisis preparedness plans of CI operators, contingency plans of ČEPS, electricity distribution companies and electricity producers and in regional contingency plans. The plans address e.g. the assessment of the impact of the threat on the operation of the entity, its preparedness and response measures (e.g. the acquisition of backup generators and stockpiles of suitable fuel). Cascading effects that could be caused by blackout are also taken into account. The plans take into consideration the possibility of declaration of the state of crisis, should the situation become serious (long-term outage, outage in a large area).
In order to strengthen energy resistance against the blackout, in 2019 the government approved the Procedure for Creating a List of Strategic Facilities, Determining Their Priorities and Defining Scenarios of Large-Scale Electricity Supply Disruptions based on State Energy Concept of the Czech Republic approved in 2015. It aims to identify strategic facilities in the Czech Republic and to prioritize the electricity supply to them during the recovery of electricity supply after the blackout. Strategic facilities are defined as facilities whose operation is crucial for protecting the life and health of the population, maintaining the safety and operation of CI or environmental protection. Critical infrastructures can also be part of strategic facilities. Based on this document, individual regions identify strategic objects in their territory and determine their priority in terms of vulnerability in relation to power outages and the severity of outage of the service provided by the specific strategic facility. The result will be a categorized list of strategic facilities in the Czech Republic which will be used by distribution system operators in their shutdown plans. In the process of strategic facilities identification, their ability to use backup source of power is also considered. This can be ensured by acquisition of a backup generator, or by creating a connection point for mobile backup generator.

Provision of a backup energy source for significant facilities (critical infrastructures, strategic facilities, etc.) is thus considered one of the priorities. The most important facilities (e.g. medical facilities) already have

a backup generator, although the issue concerning their limited operation time (due to the capacity of fuel tanks or durability of UPS batteries) remains. However, less important facilities (such as sanitary facilities, farms, etc.), usually don't have any backup generators. In this case, it is possible to use backup generators from the state material reserves, but the number of these generators would not be sufficient in the event of a blackout on a larger territory. The situation can be improved by imposing the obligation for significant facilities to acquire a backup generator. This can be, however, very costly for some operators, especially those with large facilities. Possible alternative would be acquisition of more backup generators into the state material reserves and helping the companies to create connection points for such generators[22].
The energy sector in the Czech Republic is one of the critical infrastructure sectors. Critical infrastructure operators must comply with obligations set out in the Crisis Act (compilation of a crisis preparedness plan, enabling infrastructure inspection by the respective authority, designation of a security liaison officer, reporting all changes that can affect the designation of the critical infrastructure). Central administrative authority responsible for the energy sector is the MoIaT[23].

In the scope of blackout preparations the Czech Republic also holds exercises, mainly on the regional level. In recent years, there have been exercises in Prague (2014), the South Moravian Region (2015), the Vysočina Region (2016) and the Central Bohemian Region (2018). A large number of both table-top and field exercises are also organized by the transmission and distribution system operators, such as the company ČEZ, in cooperation with various state and private entities. In last years, some exercises (such as Restart 2013 and Drill 2014) aimed at restoring operations of the electricity grid in the event of outages were carried out. These exercises also took into account cross-border impacts and therefore, foreign partners participated in these exercises as well.

The main findings of these exercises can be summarized as follows:

- After a large power outage, full recovery of power supplies would be possible in 24-26 hours at the earliest,
- Continuity of operation of the most important crisis management bodies and infrastructure is secured by backup generators, but health facilities are able to operate only for a limited time of several hours (due low capacity of fuel tanks). Social facilities (e.g. retirement homes) do not usually have backup generators at all,
- The most effective blackout measure is to secure electricity supplies in islanded mode of operation,
- Drinking water pumping stations cease to operate immediately after a power failure. After the recovery of electricity supply, the supply of water in the quality of non-potable water would be renewed within 24 hours and in the quality of drinking water within up to about a week,

Critical infrastructure operators were advised to be equipped with backup generators and to have a fuel supply for their operation for 72 hours or to be technically prepared for the connection of an external generator and to have secured a fuel supply.

2.4. Epidemics

An epidemic is defined as the occurrence of an infectious disease as a result of which the incidence of this infectious disease in a certain area and at a certain time increases above the limit usual in a given locality and in a given time. Epidemics appear either in case of infections that occur regularly or sporadically on the territory of the Czech Republic or they are brought from other territories where their occurrence is endemic but atypical for the Czech Republic. Also, it can be a completely new type of infectious disease, regardless of its origin. The Czech Republic may also be affected by an epidemic of infectious disease that affects more than one continent. Such epidemic is defined as a pandemic.
According to the Risk Assessment for the Czech Republic, epidemic was assessed as a danger with unacceptable risk; therefore a state of crisis is expected to be declared if an epidemic should occur.

Several laws are applicable for this type of danger. Among these are in particular Act No. 258/2000 Coll., on the protection of public health, Act No. 240/2000 Coll., on crisis management and Act No. 241/2000 Coll., on economic measures for crisis situations. Other applicable legislative documents are e.g. Act No. 372/2011

[22] In 2020 FRS prepared a Methodology for the Construction of Connection Points for Backup Generators, which focuses on crisis supply of buildings with backup generators and a reliable method of their connection as well as on standardisation of connection points.
[23] MoIaT inspects critical infrastructures in their area of expertise in accordance with the Czech Technical Standard – Physical Protection of critical infrastructure.

Coll., on health services, Act No. 374/2011 Coll., on the emergency medical service, Act No. 185/2001 Coll., on waste or Act No. 256 / 2001 Coll., on funeral services. Several ad hoc laws were also accepted to support the resolution of the current COVID-19 crisis (e.g. the Act on Emergency Measures during the COVID-19 Epidemic in 2020). In addition to legislative documents, public health protection is also addressed in non-legislative documents. These are mainly pandemic plans and the model action plan "Epidemics - human disease outbreak".

In its current version, the Pandemic Plan of the Czech Republic is based on experiences from influenza pandemics from previous years and on the International Health Regulations, which were adopted by the World Health Organization in 2005. Although the pandemic plan is primarily intended for the case of influenza viruses, it can be also used for new infectious diseases (for example SARS). The Pandemic Plan also reflects the WHO's 2009 "Pandemic Influenza preparedness and response - a WHO guidance document". Currently, it is planned to update the Pandemic Plan according to lessons learnt from COVID-19 pandemic. The Pandemic Plan of the Czech Republic also serves as a basis for regional pandemic plans and pandemic plans of central administrative authorities.
The goal of a regional pandemic plan is to identify measures aimed at reducing the impact of a pandemic on regional population. Regional pandemic plan is created by the RPHA in cooperation with the regional authority and IRS units. The pandemic plan of central administrative authority is a planning document containing procedures for the central administrative authority's response to an influenza pandemic caused by a new type of influenza virus within this authority.
The MoH also compiles model action plan "Epidemic" that introduces standard procedures, principles and measures for resolving this type of crisis which are further elaborated within individual crisis plans.

In the Czech Republic, number of different authorities are responsible for dealing with epidemic. These are primarily public health protection authorities defined in the Public Health Protection Act. The principal authority is MoH, which can declare emergency measures according to the Public Health Protection Act. It is also in accordance with the Crisis Management Act authorized to ensure the purchase and distribution of the necessary medical products, even the unregistered ones. At the request of the regional authority, MoH is also authorized to coordinate the activities in providing urgent care of emergency medical service providers and acute inpatient care providers who have established an emergency admission or status of specialized center and is also authorized to regulate the provision of health services according to the Act on Economic Measures for Crisis Situations.
Within MoH, the position of CPHO has also been established, acting in matters of public health protection and support. CPHO is appointed directly by the government.
At the regional level, the public health protection authorities are the RPHAs. They can declare emergency measures for epidemics and in case of danger of its occurrence, monitor and evaluate the development of the epidemiologic situation and carry out risk assessments. They are also authorized to perform investigation in the outbreak area, confirm suspicion of epidemic occurrence, report mass occurrence of a disease, transport suspected cases to the place of isolation and order them to undergo isolation and treatment. They also prepare decontamination of persons and disinfection of objects and environment. RPHAs also perform microbiological diagnostics and based on their results, determine the necessary measures to restrict or prevent further spread of infectious diseases and inform the public in cooperation with the media.

Another public health protection authority is the Chief Public Health Officer of the MoD, who establishes working group composed of experts from the Military Medical Service to deal with the crisis situation. The Chief Public Health Officer of the MoD cooperates with the MoH and the territorially responsible public health protection authority and declares measures to protect public health within the scope of his responsibility, although these measures have to abide by the regulations already declared by the MoH.
The Public Health Protection Authority of the MoI also performs the public health protection tasks. It performs epidemiologic activities and orders measures to protect public health within the scope of its responsibility (primarily in relation to the Czech FRS and Police and their employees).

In addition to the public health protection authorities, there are also epidemiologic committees. At the central level, it is the CEC, a permanent working body of the government chaired by the Minister of Health. The CEC coordinates and supervises public health protection capabilities of central administrative authorities to be able to act in the event of the serious infectious diseases occurrence. The CEC also decides about the extent of data collected to evaluate and determine anti-epidemic measures in the Czech Republic. During the period of its activation, it becomes integral part of the Central Crisis Staff during. REC is the working body

of the regional governor for dealing with large-scale epidemics and its chairman is the director of the local RPHA. If state of crisis is declared, REC becomes part of the regional crisis staff.
Government Council for Health Risks was established during the current COVID-19 crisis as a permanent advisory body to the government. Its basic task is to address and respond to all situations related to health risks for population in the Czech Republic, to promote measures to eliminate these health threats and to oversee activities of the Integrated Central Management Team. The Chairman of this Council is the Prime Minister and his deputies are the Minister of the Interior and the Minister of Health.

The Integrated Central Management Team is the executive working body of the Government Council for Health Risks of the Czech Republic. Its task is to manage and coordinate the measures taken to address the relevant health risk. The team ensures operational management, monitoring and evaluation of the measures taken to prevent the spread of viral disease from the outbreak area to other areas of the Czech Republic.

Together with the declaration of a state of crisis, crisis measures[24] can (and should) be declared to deal with the epidemic. Crisis measures are organizational or technical measures designed to address the crisis situation and eliminate its consequences, including measures that restrict basic rights and impose special obligations to individuals. During the state of emergency, the government can declare the crisis measures in the necessary extent and for the necessary time frame only. Crisis measures were also declared during the Covid-19 epidemics in the Czech Republic with the aim to reduce spreading of Covid-19 among the population. There is, however, one disadvantage of crisis measures - they are directly dependent on the declaration of the state of crisis. When the state of crisis is repealed, the effect of these measures ends with it. Another, more specialized tool for the public health protection are emergency measures of public health protection authorities, which can be ordered even at a time when a state of crisis has not been declared or has ended.

Emergency measures[25] are declared by public health authorities within their territorial jurisdiction. Emergency measures include:

- prohibition or restriction of the production, storage, transport, import, export, sale and other handling of food and other products which may spread an infectious disease, or issuing an order to destroy them,
- prohibition or restriction of contact between groups of persons suspected of being infected with other persons, restriction of travel, ban or restriction of festivities, public performances, sporting events and other gatherings and regulation of ambulance and inpatient care, social services facilities, schools as well as accommodation facilities and restaurants,
- ban or restriction of the production, treatment or transport of drinking water and a ban on the use of water from wells, springs, reservoirs, ponds, streams and rivers,
- order to allocate beds in medical facilities,
- order to carry out focal disinfection, disinsection and deratization in the affected area,
- order to mark buildings or areas where the infectious disease has appeared,
- emergency vaccination and preventive administration of other medicaments,
- order to allocate an object owned by the state, region or municipality for isolation or quarantine of persons,
- prohibition or regulation of other activities in order to eradicate the epidemic or decrease the risk of its occurrence.

This tool was used during the first wave of the Covid-19 epidemics. As crisis measures of a similar nature ceased to apply with the end of the state of emergency, it was still necessary to ensure the implementation of certain measures. The declared emergency measures were aimed at allocating beds in medical facilities, banning or restricting contact of suspectedly infected persons or closing medical facilities, social services facilities, service establishments or restricting their operation. During the first wave, an emergency measure introducing the obligation to wear face mask in building interiors and public transport was also declared.

During the rapid spread of the disease, public health protection authorities use the IS Pandemic whose main function is to monitor the spread of acute respiratory or other diseases during the state of emergency.

[24] According to Crisis Management Act
[25] According to Public Health Protection Act

It collects daily reports from public health protection authorities and converts the obtained data into tables and graphic representations. Furthermore, the Smart Quarantine project was launched. It can be described as a set of measures, procedures and tools designed to detect a threat to public health and subsequently respond to epidemiologic situation. This project covers the entire process of testing, contact tracing and ordering quarantine. Smart Quarantine tools and measures (for example augmenting of the call centers, increasing the capacity of testing centers and laboratories) can be flexibly adjusted according to the intensity of the epidemic and with regard to risk assessment and prediction of epidemiologic situation. The MoH is responsible for management and coordination of Smart Quarantine.

The system of contact tracing is set up sufficiently and is continuously adjusted on the basis of new knowledge and approaches (for example self-tracing). However, it soon became clear that the regional public health authorities are not able to carry out tracing quickly enough on their own when the number of infected persons rises above certain amount and they have to be augmented by military personnel or volunteers. It would be desirable to augment the regional public health authorities and provide them with more effective tools for tracing.
The Smart Quarantine also includes the eRouška ("eMask") mobile application which records anonymous data about encounters with other users. If any of them was tested positive for Covid-19, the application will issue an anonymous warning concerning the possible risk of coronavirus infection and recommend further action to all users who found themselves in close proximity to the positive user. eRouška uses Bluetooth technology which operates properly even without mobile and GPS signal. The application does not record data about the user's location; it only detects contact with other users of the application. Version 2.0 is based on the Apple/Google protocol which guarantees the security of the application on Android and iOS platforms and reduces battery consumption. The first version of the application was created as part of the COVID19CZ initiative[26], and was subsequently transferred under the state authorities under the name eRouška 2.0. The administrator of the application is currently the MoH in cooperation with the National Agency for Communication and Information Technologies.

At the end of July 2020, the MoH developed a traffic light system for the Czech Republic, in which 4 levels of alert are set on a scale of 0 to 3 (0 meaning none to negligible risk and 3 increasing or persistent community transmission). Each stage sets out a framework of procedures and actions public health authorities should take in the context of the Covid-19 epidemic preparedness and response system. These include the activation of crisis staffs and crisis lines, the management of the capacities of testing centers and laboratories, activation of the Intensive Care Dispatcher or the involvement of the Army of the Czech Republic. A key component are also measures concerning inpatient care, which include entry triage, bed re-profiling, or allocation of staff for Covid-19 patients.
The traffic light system also determines possible measures towards the general public. Each stage is linked to a package of anti-epidemic measures, such as the obligation to wear face masks, restricting the number of people at events, restricted opening hours of restaurants and recommendation of other measures (hand washing and disinfection, respiratory hygiene, keeping the distance from strangers). The measures also include recommendations for health and social service providers.

In relation to critical infrastructure, the sectoral criteria for critical infrastructure identification have changed during first wave of Covid-19; the healthcare sector has been expanded to include the pharmaceutical manufacturers. Protection of critical infrastructures is addressed by the crisis preparedness plans, which contain measures to protect the critical infrastructure from disruption of its function. Hospitals and other healthcare facilities are not designated as critical infrastructures, although there is existing sectoral criterion for their designation[27]. A change in this sectoral criterion to address this issue is currently being considered. Nevertheless, all the medical facilities are still considered as important and are therefore regulated by the Cyber Security Act and the NIS Directive as operators of essential services and operators of important information systems. Three serious ransomware attacks against these medical facilities were identified in the Czech Republic between the end of 2019 and the Q2 of 2020 (at the time of the state of emergency or shortly before its declaration). The attacks encrypted the data of the affected institutions, significantly reduced their operability and caused financial damage in the tens of millions CZK. Since April 2020, other medical facilities were also attacked in a similar way. NCISA created the Minimum Security Standard in response to these threats, which was published in July 2020. Security Standard is intended to help

[26] In the spring 2020 established initiative of Czech technological companies and ICT enthusiasts focused on help to resolve COVID-19 crisis.
[27] Sectoral criterion for health facilities is set for health facility with more than 2 500 acute care beds

strengthen cyber security of smaller organizations that are not covered by the Cyber Security Act. During autumn 2020, NCISA also organized an exercise called HealthCzech focused on the cyber security of medical facilities.
During an epidemic, the healthcare system is especially vulnerable to cyber-attacks as its capacity is burdened by an increased number of patients. During the first wave of Covid-19, all cyber-attacks on medical facilities were successfully resolved. However, this sort of health system overstraining should be prevented by strengthening the cyber resilience of the facilities concerned.

In terms of financing measures to manage this type of threat, the Czech Republic follows the "all-hazards approach". Funding of crisis measures is carried out in accordance with Act No. 218/2000 Coll., on budgetary rules and Act No. 250/2000 Coll., on budgetary rules of regional budgets. Ministries and other central administrative authorities along with regions and municipalities allocate financial resources needed to ensure preparation for emergencies in their budgets. At the same time, the regions and municipalities allocate a reserve for resolving these situations and eliminating their consequences in their budgets.
Additional funds for resolving crisis situations are allocated within the state budget in a special-purpose reserves in the General Treasury Administration chapter. These are the Reserve for resolving crisis situations, their prevention and removing of their consequences under the Crisis Act, the Reserve for extraordinary expenses under the Integrated Rescue System Act and the Government Budget Reserve, which the Ministry of Finance may use should the both specialized two reserves be exhausted. The regions may be provided with a quick special purpose subsidy from the Reserve for resolving crisis situations in the maximum amount of 10 millions CZK when the state of crisis is declared. This subsidy is intended to cover initial costs in the scenario where the region's funds have already been depleted. After the exhaustion of all the funds that the central administrative authority or region has allocated in its budget for crisis management purposes, they may also request the release of additional funds from the Reserve for resolving crisis situations.

Concerning the availability of personal protective equipment and medical equipment, the situation changed significantly during the first wave of Covid-19. Before the crisis, the amount of said equipment was insufficient and most public administration authorities and private companies had personal protective equipment either in limited amount or not at all. This was caused by the effect of continuous supply trend, which can be characterized as holding minimum stocks and continuous ordering of protective equipment according to the current consumption. The Covid-19 pandemic clearly showed the need of keeping a sufficient supply of the protective equipment at all times preemptively, as purchase of such equipment was extremely difficult after the beginning of the world-wide Covid-19 pandemics.
In May 2020 the MoIaT proposed the creation of state material reserves for the provision of personal protective equipment and medical equipment for the cases of crises. All the central administrative authorities were tasked to revise their crisis documentation and plan in such manner so that they would be self-sufficient for at least 1 month in their consumption of personal protective equipment. Consumption for the next two months is then to be secured from the stocks of the AoSMR.
The AoSMR subsequently acquired several types of protective and medical equipment such as disposable protective suits, disposable examination gloves, shoe covers, protective goggles, protective shields, FFP2 and FFP3 respirators, Covid-19 rapid tests, medical face masks and devices for lung support and blood oxygenation. However, in order to address the epidemic, it will be necessary to further increase these material capacities, especially the reserve bed capacities and other equipment, which can increase the capacities of the healthcare system during a pandemic.

2.5. The Right to Receive Information about Risks

According to the Crisis Management Act, both individuals, entrepreneurs, and companies on the territory of the Czech Republic have the right to be granted information about the possible threats to the population, planned emergency measures to safeguard the safety and security of the population, their lives, health and property and how exactly these would be performed. This information is provided by the municipal authorities, usually via their notice boards, websites, or specialized information offices with flyers, brochures, and similar prints. The content and extent of the provided information are determined based on the threat analysis included in the contingency plan of the particular region and the respective authority can discuss it further with the experts from FRS and other security experts in the region.
The Crisis Management Act also introduces the obligation for the television and radio broadcasters to broadcast information on the declared state of crisis and related crisis response measures. They have

to do so immediately, without any change of meaning or content and without having the right to reimbursement for possible costs after receiving such a request from crisis management authorities. This usually takes the form of a text banner on the TV screen or a special relation in radio broadcasting. For some specific emergencies, such warnings are prepared and pre-recorded, for example, floods and radiation accident.
Special information is also given to people in specific locations (e.g. contingency planning zones around nuclear power plants, chemical plants, water dams) informing them about the specific risk stemming from the facility in question, measures planned (or undertaken) to mitigate this risk and what can they expect if something was to happen.

2.6. Early Warning Systems

The warning of the population in case of an emergency is performed via a JWNS[28], complementary also via cell phone applications, television, radio, local radio. In specific cases, mobile sirens, police patrols, and others may be used. The JWNS consists of notification centres, data network, radio networks, end warning elements (sirens), and end detection elements. 85 % of the populated area of the Czech Republic is covered with this warning signal. The equipped sirens are either rotary (electromechanical, 5300 pcs.) or electronic (1900 pcs.) and they are assisted by local information systems - local wireless radio broadcasters integrated into the system (2200 pcs.); all of them controlled remotely.
Next to sirens used for acoustic warning, the system is also equipped with the end detection elements that steadily monitor specific values and report them to the system: water level sensors (usable for oncoming flood warning), sensors of pressure inside of closed vessels or pipelines (usable for explosion or pipeline defect warning) and sensors for ascertaining values of various physical quantities or presence of chemical substances in the air (in the vicinity of chemical plants, dairies, skating rinks, etc., enabling detection of chemical leakage). These end detection elements are connected to the JWNS and if they measure a value higher than the specified limit, it triggers the warning element of the system, and the population in the potentially dangerous zone is warned, including basic emergency information on why a warning is being issued. Presently, there is only a limited number of these detection elements; they are usually equipped during the replacement of electromechanical sirens for the electronic ones.
Although this system is highly reliable, its characteristics (mostly analogue and one-directional) result in certain limitations. Therefore, a plan has been developed to build a new, fully digital warning system, which execution will nevertheless be very lengthy and expensive. This modernisation is covered predominantly by European Structural and Investment Funds (specifically by Integrated Regional Operational Programme).

2.7. Raising the Public Awareness and Population Preparation

Population preparation for emergency events is a system consisting of two basic elements: Continuous education of pupils and students at schools in scope of standard educational procedures and, additionally, a number of further projects and events for the public that complement the education in schools and serve as a source of knowledge for the target groups that are no longer subject to systematic education. These so-called preventive educational activities in the field of population protection are mostly performed by the FRS in close cooperation with the MoEYS and occasionally also with other entities (regions, municipalities, NGOs, etc.).
The contents and form of these preventive educational activities stem from current legislation and from the required scope of knowledge and skillset that the population should possess to:

- behave responsibly and not to create any dangerous situations,
- be aware of possible risks and know how to recognize them,
- know what to do in case of various emergencies - self-protection,
- be able to protect themselves and, if possible, also others (mainly those, who cannot help themselves)

Informed and prepared civilians create a better-prepared and more resilient society as a whole.

This educational process includes all age groups: kindergarten children, elementary and high school children, adults, and senior citizens; special groups being disabled citizens and foreigners. Children are educated according to their age and capabilities with topics of increasing complexity such as how to call an emergency

[28] A secondary function of this system operated by DG FRS is alerting the fire brigades in case of their deployment.

number, practising how to behave in dangerous situations, safety on the road, improvised protection, the meaning of sirens signals, up to survival in the nature or rules of safe behaviour on the internet. The means used are varied and abundant - board games, short animated films, leaflets and brochures, DVDs, excursions to Fire Brigade stations, special sports events, debates and seminars, advertisements in public transport, etc.

An important part of educating children is also the preparation of both current and future teachers and equipping them with the necessary knowledge and teaching aids to be able to explain all essential topics comprehensively and pass the information to the children and students.
Unfortunately, the preparation of children for emergency events at schools is not concentrated into one specialized subject, but it is spread throughout several school subjects (chemistry, physics, civic education, etc.) which makes it less efficient. This is a frequent topic of discussion in various educational forums.

2.8. Preparation of Population Protection Experts
Equally important is the preparation of professional public, especially emergency management experts active on all levels of the state administration, with the aim of ensuring more effective emergency preparedness and response. Their further education is described in detail in the document called "Concept of Education in the Field of Population Protection and Emergency Management". All the individual target groups need to have their education and background materials tailored according to the specifics of their profession and needs. These groups include officers in state administration, officers in regional administration with the focus on mayors of cities, members of the FRS, police, municipal police, armed forces, but also workers from private companies and entrepreneurs (e.g. critical infrastructure operators, operators of facilities dealing with hazardous substances).
Apart from receiving useful information during courses and seminars, most of these professionals in the state service also need to pass a special thematic exam in the field of population protection and emergency management, which is legally required for them to be allowed to perform their job.

For the verification of the planning documents, crisis procedures and communication flows during emergency events, exercises are being organised. These can include both field and table-top exercises of the various extent and level (local, regional, national), regularly held and ad hoc exercises. During these exercises, the state authorities and the specific private companies work together and practice all the activities necessary to deal with the potential emergency. One of the biggest exercises in this area is "Zone" which ensures preparation for possible radiation leakage from Czech nuclear power plants and is held every two years. Apart from national events, the Czech Republic also takes part in a number of cross-border and international exercises (incl. Inex, Cyber Coalition, EU Integrated Resolve, NATO CMX).

Moreover, every year, the DG FRS and MoE jointly evaluate the measures taken based on Sendai Framework for Disaster Risk Reduction and the DG FRS compiles and publishes an annual statistical yearbook in which all the data on disaster loss are comprehensively organised and summarized.

2.9. Conclusion to Risk Management Capability Assessment
The Czech Republic builds and develops its risk management capabilities in accordance with the "all-hazards approach" principle, meaning that the capabilities are generally not created and subsequently categorized according to individual risks, but they are built generally to be able to address all the possible emergencies and crises. The only threat the Czech Republic has extensive experience with are large (natural) floods. However, the resilience system is being built and developed even in preparation for such situations that have so far never occurred to such a large extent where the situation would become really perilous and have the potential to disrupt the basic functions of the state. Therefore, the Czech Republic also disposes of various universal capabilities that can be used to address risks listed in Part I of this Report. Capabilities of the Czech Republic are aimed principally at mitigating the level of impact of the specific threat, meaning we are trying to improve the resistance of the system. Available measures are therefore primarily designed to corroborate response activities and formed while taking into account strong cross-sectoral dependencies and possible cross-border risk exposure.
Strong technical and material capabilities were identified mostly concerning large floods and their resolution. On the other hand, we have to concede to inadequate expert bodies and not well enough elaborated planning documentation in relation to drought, caused by still unresolved legal regulation of this area. We hope that with the approval of the new Water Act, this should change rather rapidly for the better. When it comes to blackout, material and technical equipment would be the most probable weak point. Because the Covid-

19 emergency is still ongoing, it is difficult to reliably assess all the prevention and preparedness components but it is clear that several identified planning, legislative, and provisions weak points will be addressed (or already have been addressed to enable more effective resolution of the pandemics).
The use of non-budgetary resources in the form of project funding from European Structural and Investment Funds has proved to be very effective. Thanks to these funds it is possible to effectively develop the capabilities of the Czech Republic and mitigate the impacts of some key risks. Because the identified supercritical risks are characterized by their synergic and cascading impact on numerous other sectors, universal capacities were built via capacity building for these specific risks.
Finally, it must be stated that across all the evaluated threats there is a high level of elaboration of their aspects within strategic and conceptual documents.

Part III: Priority prevention and preparedness measures addressing key risks with cross-border impacts and low probability risks with a high impact

3.1. Risks with cross-border impacts

In the Risk Assessment of the Czech Republic, several threats have been identified that could potentially negatively affect its neighbouring countries. Even though it is not always clear if their impact would actually overflow to another state, with some of them it can be reasonably expected.
In the Czech Republic, the highest probability of a transboundary effect lies by some of the risks already described in Part II and further in Part III of this document; these are namely:

- flood,
- blackout (its spreading to neighbouring countries),
- epidemics,
- radiation accident,
- industrial accidents.

Industrial accidents are usually dealt with within the contingency planning system by means of standard response forces but in case of certain large emergencies, their resolution can be shifted onto the crisis management level. With these risks, the major part of provisions lies in the mutual exchange of information, situation predicting, and possible warning. Where possible, joint planning (flood - the work of international committees of specific catchment areas), exercising (flood, blackout[29]), and outlining of feasible preventive and preparedness measures is also executed.

The Czech Republic is also prepared to provide aid to its neighbours (and also to other countries), primarily material and humanitarian, but also in form of dispatching FRS units, experts, etc. For example, in August 2002 the FRS units of two regions were sent to Austria haunted by floods. They assisted the Austrian colleagues with remedy works and removing the effects of the flood, freeing the river beds and performing other necessary rescue works. In 2010, further FRS units were dispatched to Poland and Slovakia during large floods.

3.1.2. Agreements with Neighbouring Countries

The Czech Republic signed treaties about mutual cooperation and help during catastrophes and large accidents with all its neighbouring countries (as well as with a number of others), most of them shortly after the establishment of the independent Czech state. Additionally, in 2013 two agreements between the Ministry of the Interior of the Czech Republic and the Ministries of the Interior of Bavaria and Saxony were signed. The cooperation with Poland and Slovakia also encompasses the creation of methodologies for fire protection units' cooperation; the Czech Republic organizes regular meetings with these countries, where the rules for cross-border collaboration are further specified and detailed. Furthermore, past cross-border interventions during emergencies are evaluated, protection of streams in the vicinity of the border is discussed, as well as measures for population protection, the engagement of the Czech Republic in rescue operations and humanitarian aid, and the topics for cross-border exercises.

State	Treaty approval/ In effect since	Treaty name
Germany	19.9.2000 / 1.1.2003	Treaty between the Czech Republic and the German Federal Republic on mutual help during catastrophes and large accidents
	27. 8. 2013	Agreement between the Ministry of the Interior of the Czech Republic and Bavarian State Ministry of the Interior, for Sport and Integration on the execution of the Treaty between the Czech Republic and the German Federal Republic on mutual help during catastrophes and large accidents from 19 September 2020

[29] On September 16, 2014 an international exercise DRILL 2014 was executed near the German border in the vicinity of the city Hora Sv. Šebestiána with the aim to practice coordinated intervention of integrated rescue system units and electricity transmission system operators during the renewal of disrupted electricity transmission and resolving the impact of large emergency event. Among the participants were FRS, Police, Emergency Medical Service and Army of both the Czech Republic and Germany as well as electricity transmission system operators from both countries - specifically ČEPS and 50Hertz companies. The exercise simulated a significant damage on the transmission network and subsequent large forest fire ignited by an electrical discharge. The intervening units and companies had to simultaneously work on extinguishing the fire and building a substitute power line.

	27. 8. 2013	Agreement between the Ministry of the Interior of the Czech Republic and Saxony State Ministry of the Interior on the execution of the Treaty between the Czech Republic and the German Federal Republic on mutual help during catastrophes and large accidents from 19 September 2020
Austria	14.12.1998 / 1.11.2000	Treaty between the Czech Republic and the Austrian Republic on mutual help during catastrophes or large accidents.
Slovakia	23.11.1998 / 12.12.2000	Treaty between the Czech Republic and the Slovak Republic on cooperation and mutual help during emergency events
Poland	8.6.2000 / 16.8.2003	Treaty between the Czech Republic and the Polish Republic on the cooperation and mutual help during catastrophes, natural disasters, and other emergency events.

Table 3: List of international treaties of the Czech Republic with neighbouring states in the field of emergency response.

The contents of the treaties consists generally of agreement on various measures in two main areas: preventive and preparedness actions. A large part of the provisions is also aimed at large industrial accidents and environmental protection.
Preventive measures include e.g.:

- Exchange of information about possible threats and consequences of disasters and industrial accidents which can extend onto the territory of the other state,
- The means of conveying the gained data,
- Ascertaining the causes of disasters and industrial accidents,
- Forecasting and conveying measurements,
- Exchange of best practices, lessons learned and scientific and technical information, including study visits for experts, tutelages, expert courses, and joint exercises,
- Joint research programmes and activities,
- Cooperation of educational institutions and joint exercises organisation.

With some neighbours, developing a bilateral warning and information system for industrial accidents and other cases of serious environmental contamination was also agreed upon.

Preparedness provisions encompass:

- Dispatching rescue units or experts,
- Humanitarian and mutual material aid,
- Providing all the necessary information including those needed for the protection of citizens in third countries and information on emerging industrial accidents and other exceptional cases of environmental contamination,
- Introducing efficient precautions for mitigating consequences of industrial accidents and similar emergencies,
- Means of cooperation during the removal of contamination and its effects.

Some further details on the individual treaties and cross-border cooperation follow:

Cooperation with Germany
The FRS actively works together with the German Federal Agency for Technical Relief, especially in the form of joint training (stabilization of damaged buildings, safe driving training, best practices and information exchange in the field of explosives handling, professional chainsaw handling, etc.). Some areas of cooperation (ensuring emergency drinking water supply, the building of temporary bridges destroyed during a disaster) include also Czech (and Slovak) AoSMR.

Cooperation with Austria
In the beginning, the collaboration was undertaken mostly by the FRS of the South Moravian region and firefighting units of Lower Austria. Presently, it is carried out in a wider manner in form of information and best practices exchange, consultations, school and educators interaction (Floridsdorf, Klagenfurt), joint training (wild river water rescue), joint exercises (e.g. EU-DREx or MODEX exercises), and joint efforts to finding solutions to some challenging problems (electric cars operation safety).

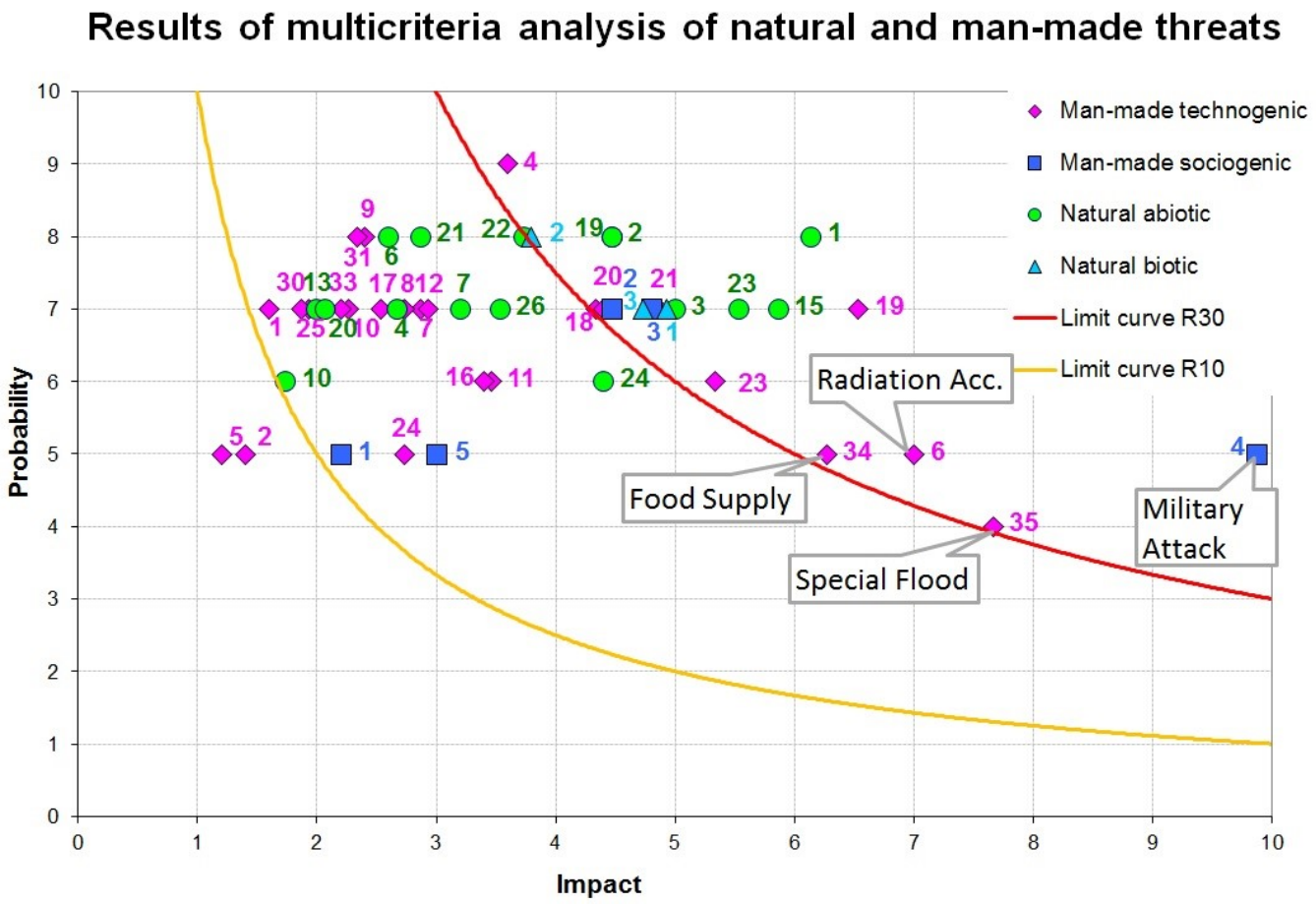
Cooperation with Slovakia
The main areas of cooperation with Slovakia are professional training, research and testing, communication and information systems, specialised press and repair facilities, joint interventions, and exercises. In 2014, the Working Group for crisis management, civil protection and integrated rescue system was established in the scope of the Czech and Slovakian Intergovernmental Committee for Cross-border Cooperation. During its meeting in March 2016, several agreements about cross-border cooperation and mutual help were signed between FRS of bordering regions, regional directorates of Slovakian Firefighting Brigades and Slovakian regional authorities. Since 2018 a permanent representative of Czech FRS is stationed in Bratislava, Slovakia.

Cooperation with Poland
There is an annual meeting of an Intergovernmental Committee for Cross-border Cooperation (place of the meeting alternates between Poland and the Czech Republic). At the same time, a Working Group for the fight against catastrophes, disasters, industrial accidents and eliminating their consequences summarizes its existing cooperation and discusses areas of further cooperation for the oncoming period (e.g. cross-border intervention, joint regional exercises). There are also numerous meetings of DG FRS with the commander in chief of State Fire Service of Poland, discussions within annual meetings of civil protection directors-general of V4 countries, at fairs and during exercises.

3.2. Low Probability Risks with a High Impact
Based on the results of the performed Risk Assessment, the Czech Republic decided to indicate the following three risks as key low probability risks with a high impact:

- special flood (caused by disruption of a water dam or similar facility retaining a large amount of water),
- radiation accident,
- large-scale disruption of the food supply.

All these three risks are above the critical 30 point value line with serious impact (risk score values of 30,67, 35, and 31,33 respectively) but the probability of their occurrence is relatively low - 5 or less. We plan for these emergencies carefully, despite the smaller probability of their occurrence. In case of a radiation accident, the Czech Republic has more experience (albeit theoretical) thanks to the thorough bi-annual exercises aimed at training for this type of emergency. The experience concerning the other two emergency types is rather limited because in the last decades there was basically no exposure to them.
In the picture below, you can see the position of these selected risks in relation to the other risks.



Picture 5: Position of the special flood, radiation accident, large-scale disruption of food supply, and military attack in the risk matrix

A special case is the risk of a military attack on the Czech Republic which scored the highest value of all identified threats in the Risk Assessment - 49,33. Its probability is relatively high and growing with the increasingly turbulent geopolitical situation, and its impact would be drastic. Dealing with such specific risk via the "standard" system for resolving emergencies would be inappropriate and ineffective; the risk is so dissimilar to other risks, that there is a different, specialised part of the emergency planning system and system of economical measures for the states of crisis set up, compliant and integrated with the NATO planning system. This stems from specialised laws[30] which are different from the Crisis Management Act. Among the most important national plans are the Central Plan of State Defense, the Plan of Mobilisation Supplies, the Plan of Territory Operation Preparedness, and Partial Defense Plans of individual authorities.

3.2.1. Special Flood

The special flood is defined as flood wave caused by artificial effects or by combination of natural effects and other factors e.g. by failure or accident of water dam, malfunction of dyke locking mechanism in safety and drain equipment of water dam or by performing an emergency measure during critical situation at a water dam that leads to emergence of emergency in the area below the water dam. There are three basic types of special floods:

- Special flood type 1 – rupture of dyke of water dam – often leads to its complete failure. Experience shows that every major flood causes damage to dozens of dykes of ponds, especially protection dykes. In many cases there is a complete dam failure (during the flood in the 2002, there were 85 seriously damaged dams of small water pools, and complete failure of 23 dams registered),
- Special flood type 2 – malfunction of dam locking mechanism in safety and drain equipment of water dam. It can lead to uncontrolled runoff from the reservoir. Impacts of such type of special floods are not as catastrophic as they are in the first case.

[30] Predominantly the Defence of the Czech Republic Act

- Special flood type 3 - emergency solution of critical situation at water dam that can lead to emergency water release (goal was in many cases to save water dam from its rupture).

The territory endangered by the special flood is defined as the area that can be flooded with water during the special flood and it is generally significantly bigger than flood territory of natural flood. The size of this territory is defined in the "Plan for protection of the area below the water dam against special flood" and it is consequently elaborated in crisis plans.
Consequences of special floods include threats to health and lives of people, property damage, damage in agriculture, disruption of critical infrastructures, landslides and rockslides, pollution of the environment, disruption of electricity, gas, water or telecommunication supply, disruption of transport infrastructure, damage or destruction of residential and civil buildings and industrial facilities.
The legal framework of the protection against all types of floods consists of the Water Act and its implementing regulations, Act on the Integrated Rescue System and Crisis Management Act and their implementing regulations in case of severe floods. Other important documents are mainly methodologies, for example:

- Methodical instruction of MoE for identifying effects of special floods and their integration into the flood plans. Its purpose is to specify the process of quantification of special floods and the process of establishment of standard limits for evaluation of the extent of consequent threats for water management infrastructure. This instruction is used mainly when new flood plans of territorial units or flood plans of defined facilities that are potentially threatened by special floods.
- Methodical instruction of MoE for elaboration of the plans for protection of the area below the water dam against special flood that specifies procedures for elaboration of this plan and also serves as a basis for unification of approaches to dealing with the special floods among owners and operators of water dams, administrators of watercourses, relevant state authorities and public service authorities.
- Methodical instruction of MoE to secure early warning and flood forecasting service, that specifies the system of early warning and forecasting service, whose organization is managed by the MoE. It specifies early warning profiles at a water dam including identification of relevant limits of flood activity level.

Degrees of flood activity according the Water Act are set up on the basis of parameters for special flood. The effects of special floods in watercourse below the water dam are quantified in a similar way:
First degree (state of vigilance) – comes into effect when the limit values of monitored measurements are reached or when exceptional conditions are detected that could lead to special flood. At the threatened water dam, the flood patrol service is activated.
Second degree (state of alert) – is proposed by the operator of the water dam when defined limit values of monitored effects are exceeded. The operator has to immediately inform relevant flood authorities, which then declare the second degree of flood activity. The operator also informs the FRS of the region and watercourse administrator. Simultaneously, the flood warning service is activated. At the same time, the operator initiates performing of the water dam securing activities. Owners of endangered buildings and other authorities/persons according Plan for protection of the area below the water dam against special flood initiate securing activities based on the instructions of relevant flood authority or voluntarily on the basis of information received from the water dam operator. Security activities must be coordinated within the whole affected watercourse area.
Third degree (state of danger) – is proposed by the water dam operator when defined limit values of monitored measurements reach critical values and there is a realistic possibility of critical situation occurrence. The operator has to immediately inform FRS of the region, watercourse administrator and relevant flood authorities which declare the third degree of flood activity and simultaneously decree the execution of securing activities, rescue works and evacuation. The operator also organises flood securing activities in order to prevent overflow or failure of the water dam, and organises provisional closure of the ruptured water dam.

Water Management is one of the critical infrastructure sectors in the Czech Republic. Its basic task is to provide continuous supply of drinking water in sufficient amount and in proper quality to the population. Specifically, following facilities were designated as critical infrastructures: water treatment plant Želivka[31],

[31] It is a water supply complex of buildings and technological facilities used for water treatment from water source Želivka; this complex consists of water pumping station and water treatment plant. Treated water is pumped into the regulatory reservoir and then it is transported by gravity tunnel into the main reservoir where is distributed from. The water treatment plant was built between 1965 and 1971 and is one of the largest in Europe.

water source Želivka, water source Káraný and the system of their interconnecting components[32] and water source Úhlava[33]. Furthermore, 8 critical infrastructures[34] were designated under the sectoral criterion of "water reservoir with the volume of at least 100 mil. m^3".

The responsibility for the protection of critical infrastructures lies primarily in the hands of their operators that elaborate crisis preparedness plan. This plan includes: measures to protect the critical infrastructure, requirements for securing operation of critical infrastructure during crisis situation, system of protection and preventive measures to prevent crisis situation, manipulation regulations of water dam for crisis situation of floods and large-scale floods and Program of technical and safety supervision concerning crisis situations of dyke disruption of important water dams with occurrence of a special flood. Procedures are set up for critical infrastructures that include e.g. the minimal number of employees necessary for the functioning of the crisis staff of companies, water management dispatching centres, labs and important water dam facilities in case of epidemic or pandemic. According to Standards of Physical Security, the protection is assured in accordance with internal security measures and standards of individual facilities – external protection (fence, warning signs, etc.), surveillance camera system, backup generators, fire alarm system, electronic safeguarding systems, special locks, security cards with entrance permission, etc.
The safety of the water dam or dyke during the flood is assessed gradually by its importance in terms of the possible damage that would be caused by its disruption. The importance of water dam or dyke in terms of possible damage is deduced from inclusion of the dam or dyke into respective category. For the purpose of supervision, the individual water dams are classified into these categories according to expected scale of damage in the area below the water dam in case of possible accident (dyke rupture), specifically according to the number of points achieved in the damage potential (P). All respective categories are described in the table below.

	(P)	> 1500	Category I.
200 ≤	(P)	< 1500	Category II.
15 ≤	(P)	< 200	Category II.
	(P)	< 15	Category IV.

Table 4: the four water dam categories

The parameters of a water dam are derived by the scale of special flood impacts, particularly by the capacity of spillway. Dam failure statistics show that overflow of spillway is one of the most probable reason for their rupture. The required safety level of water dam during the floods is described in the table below; it also expresses the required capacity of protective technologies at the water dam in connection to the probability of test flood wave occurrence.

Water dam group	**Indication of the scale of damage**	**Water dam category**	**Evaluation aspects**	**Required safety level of the water dam**	
				P = 1/N	**N**
A	very high	I. - II.	Significant loss of life is expected	0,0001	10 000
		II.	Loss of life is unlikely	0,0005	2 000

[32] Water source Želivka supplies the capital city of Prague and other towns and villages in Central Bohemian and the Vysočina regions with drinking water. Water source Káraný is the second most important source of drinking water for Prague. Unlike other sources, Káraný is groundwater source.
[33] The course of the river Úhlava is the only source of drinking water for Pilsen. Surface water from the river has been used for the production of drinking water from the very beginning, but the considerable variability in quality and the occurrence of new types of pollution have led to the addition of water treatment technology. In the 2013 - 2016, a significant modernization and reconstruction of the water treatment plant took place with the use of financial support from the State Environmental Fund.
[34] In most cases, these are water dams of the 1st category (Water dam Lipno I., Orlík, Slapy, Slezská Harta, Nechranice, and Švihov) and partly of the 2nd category (Vranov and Nové Mlýny).

B	high	III. - IV.	Losses on individual lives are expected	0,001	1 000
			Losses on individual lives are unlikely	0,005	200
C	low	IV.	Damages below the water dam and loss of utility	0,01	100
			Losses appear only for the owner, other damages are insignificant	0,02 to 0,05	50 to 20

Table 5: N = frequency of flood by years; P = required security level and thus probability of exceeding of culminating flow wave of control flood that is necessary transfer over the water dam.

Water dam safety is the responsibility of water authorities. Among water authorities are municipal authorities, regional authorities and ministries. The MoA acts as a central water authority and it is also the central authority in the field of technical and safety supervision over water dams. Regional authorities perform the technical and safety supervision over water dams, grant permission for their construction, decide about their inclusion into respective category in terms of technical and safety supervision, approve manipulation regulations for water dams, authorise potential emergency manipulation and request the elaboration of the data about parameters of potential special flood from the owners of water dams (categories I. – III.). Water authority also provides water surveillance and check the fulfilment of obligations of legal and natural persons.
According to the Water Act, owners of a water dam in cooperation with flood authorities perform flood inspections of water dam. They are obliged to monitor all events relevant for secure management of the flood, participate in early warning flood service and inform the flood authority of the municipality, water dam operator, river basin administrator, office of CHMI and FRS about the danger of flood.
Increased attention is paid to the safety of water dams due to the fact that by their existence alone, water dams pose a significant risk of special flood emergence. Persons and authorities participating on preparation and construction of water dams and their owners must fulfil numerous obligations that are defined and supervised by the state.
Laws and legal power of regulations concerning the security of water dams in individual countries vary. Due to this reason, the NGO ICOLD provides cooperation in the field of water dam safety at the international level. The activity of this organisation is focused mainly on sharing of expert information and knowledge on planning, construction, maintaining and impacts of large water dams[35]. The Czech Republic is also member of ICOLD and Czech water dam committee acts in the role of the Czech national committee of ICOLD. Its further tasks consist of support of expert knowledge advancement from planning, construction and operation of water dams and water reservoirs for the economic and culture development of the Czech Republic.
Technical and safety supervision is regularly performed at water dams in the Czech Republic that is carried out in order to determine the technical state of water dams in terms of safety, stability and possible causes of its failure. It is carried out mainly by monitoring and inspections of water dams, measuring their deformations, observation of water leakages and also evaluation of the outcomes of these observations and measurements in relation to the defined values. The water authority decides on imposing the duty to ensure technical and safety supervision at water dams, on its scope and conditions. At water dams, patrols with the objective of monitoring of close vicinity of water dams, flow rate, regularity of all mechanisms, occurrence of rupture and visible deformations, occurrence of leakages, influences of operation and environment on the technical state of facilities and their technological equipment are regularly carried out. Patrols are carried out by staff of water dams on the predefined route at least once a day at water dams of category I., three times a week at water dams of category II., at least once a week at water dams of category III. and once per month water dams of category IV.
Management of a special flood within the territory of the region is the responsibility of the regional governor and regional authority. The regional governor is authorized to declare the state of danger, if the danger of special flood is not manageable by normal activity of administrative authorities and IRS units. When the state of emergency is declared, the river basin authorities (as operator of water dams), MoA and MoI are responsible for resolving of this situation. The MoA coordinates regions and in cooperation with Central Crisis Staff coordinates supply of equipment from emergency reserves from regions unaffected by the flood. When the special flood occurs, the owner/operator of water dam is responsible for immediate warning

[35] According ICOLD, floods can be caused by technical defect, seismic quakes, bad geological conditions and slope instability, retention of water over tolerable level, terroristic or military activity that can lead to emergence of special flood.

of the population by the means of sirens and he also immediately informs the operations centre of FRS of the region and other authorities defined by the legislation about special flood occurrence. FRS of the region warns the population in the endangered territory by JWNS.
A lot of measures can be declared to mitigate impacts of special flood such as preliminary measure against overflow or rupture of water dam (e.g. by timely decrease of the water level); informing the population about the risk of special flood; set method of warning, evacuation and information about assembly places that is presented in advance; preliminary measure to release the watercourses and to remove materials from their surroundings; continuous surveillance of water dams and further measures. All crisis management authorities have to be prepared theoretically as well as practically for such crisis.

Documentation dealing with special flood:
Model action plan "Rupture of Significant Water Dam Resulting in Special Flood" is a basic document of the MoA, setting recommended model procedures, principles and measures to deal with the special flood. This plan is subsequently elaborated in the operative part of regional and municipality crisis plans into the specific procedures to deal with the special flood at water dam, if the special flood was identified in the threat analysis by the elaborator of the crisis plan as significant risk for the affected area.

The protection plan for the area below the water dam against special flood is an operational plan containing a way to ensure timely and reliable information on the possibility of occurrence and expansion of special flood on water dam, delimitation of areas endangered by the special flood and their marking in the map documentation, possibilities to alter the runoff regime, ensuring timely activation of flood and crisis management authorities, preparation and organization of flood protection and rescue works in the area endangered by the special flood. This plan is prepared for the area endangered by the special flood by water dam (precisely water dams of categories I. to III., which accumulate water and can cause the special floods) as a separate document. This plan is not compiled for weirs and protection dykes of watercourses. Prior to the elaboration of the plan, the owner (administrator) of the watercourse ensures the calculation of the parameters of special flood and determines the extent of endangered area. The parameters of possible occurrence of the special flood are then provided to the regional authority. These documents are used as a basis for the elaboration of the relevant parts of the plan in question. The Regional Security Council discusses the analysis of the possible threat of special floods, divides the responsibility for the processing of particular parts and sets a schedule for its compilation. The completed plan is then approved by the governor.

Excursion – past dam failures in the Czech Republic
In the recent history of the Czech Republic, three failures on water dams have occurred, in two cases there was a rupture and third case was an overflow. Failure on water dam is defined as the damage to water dam that dams up the watercourse. It does not necessarily mean the rupture of the dam, but it can also be an overflow, which results in minor damage to the construction parts of the water dam that is still able to fulfil its functions. The rupture of the dam causes a flood wave capable of destroying large areas.

Water dam	Water dam category	Year	Causes of dam failure
WD Desná	-	1916	Erroneous project + wrong technology + geological survey not conducted
WD Soběnov	IV.	2002	Extreme rainfall
WD Mlýnice	III.	2010	Extreme rainfall

Table 6: Water dam failures

The most tragic accident on the water dam was the rupture of the dam on Bílá Desná in Jizerské mountains. The soil-filled dam, which contained 260,000 m^3 of water at the time of the tragedy, ruptured on the 18 September 1916, caused 62 deaths and extensive damage to property located below the water dam. The cause of this accident was firstly considered to be an improperly chosen material of the dam together with its insufficient compaction, but a study compiled in the 1996 excluded these causes and identified the leakage of water through the dam as the cause of the rupture. The trial identified the cause of the accident as a geological fault located at such a depth where test probes were not required.

During the floods in 2002, the water dam Soběnovská (Hradiště reservoir) ruptured; the strewn part of the dam did not resist the brunt of water during the flood. When the dam was repaired, this part was built of stone-lined concrete; since the 2005 the dam fulfils its purpose again, which is to retain water for the hydroelectric power plant and to protect against floods.

An accident almost occurred also at dam Mlýnice on the Albrechtický brook; in the 2010, the dam resisted the flood, which emerged after heavy rainfall. However, the dam was not able to drain the water through the sluices and the spillways and the water flowing over the top of the dam washed away the soil under the dam. Static of the dam remained intact, repair works took place during the 2011-2012.

In the 2005, a state of emergency was declared for a part of the Vysočina region in connection with the failure of the Mostiště water dam on the Oslava River. The technical and safety supervision on the dam in Mostiště revealed faults in the tightness of the clay core and water leakages exceeding the permitted standard. Further research revealed the use of an improper material during the construction of the upper part of the loamy sealing core of the dam. Therefore an extensive overhaul was launched. The first phase of this unique event applying the jet grouting method was completed in November 2005 and was an example of the reconstruction of the sealing core of the hydroelectric plant to such an extent that has not yet been carried out in the Czech Republic or other European countries. The first phase also included equipping the dam with technical and safety supervision equipment. The second phase of the repair consisted of building a new system of measuring points to measure vertical and horizontal displacements on the top of the dyke, connecting data cables from boreholes on the top of the dyke, ensuring automatized monitoring of groundwater level and reconstruction of the top of the dyke along its entire length, including bridging the safety spillway. The repair was completed in November 2006.

3.2.2. Radiation Accident

Radiation accident is a radiation emergency event which cannot be managed by forces and equipment of the staff performing work in the current power plant shift and which requires application of urgent protective measures for the population. It can be characterized by the leakage of radioactive substances generated during the operation of NPP in active zone of the reactor (reactor core) and in the coolant of the primary circuit. The leakage of these radioactive substances is a source of risk for the radiation emergency events occurrence that can escalate into the radiation accident which can lead to a crisis situation. The actual leakage of radioactive substances can occur only as a result of the disruption of all physical protective barriers such as fuel coverage, integrity of primary circuit device and integrity of protective container. The management of a radiation emergency event is defined by the individual phases. It is a system of procedures and measures to ensure analysis and evaluation of a radiation emergency, preparedness to respond to such an event and the response and restoration after the accident.

The legal framework for the peaceful use of nuclear energy and ionizing radiation, which includes radiation protection, nuclear safety and the management of the radiation emergency events, consists of Act no. 263/2016 Coll., the Atomic Act and its implementing regulations. This set of legal documents implements the current recommendations of international organizations (e.g. International Atomic Energy Agency) and legislation which was adopted by European Atomic Energy Community (e.g. Ionizing Radiation Directive, Nuclear Safety Directive, etc.).
The central administrative authority for use of nuclear energy and ionizing radiation is SofNS, who grants authorization to perform activities in this area, registers these activities and receives reports about them. It also grants authorization to perform activities of significant importance for the nuclear safety and radiation protection. It also defines emergency planning zones around NPPs, is responsible for national monitoring programme and thus manages and monitors the radiation situation in the Czech Republic. Together with the MoI, SofNS is responsible for compiling the National Radiation Contingency Plan and its consequent updating. It also conducts exercises and is responsible for international cooperation in this field (provides information to the International Atomic Energy Agency, European Commission and other European Union and EURATOM bodies).

SofNS also established public research institutions such as the National Radiation Protection Institute[36] and the National Institute of Nuclear, Chemical and Biological Protection[37].

The radiation situation in the Czech Republic is monitored primarily by the Radiation Monitoring Network, which was designated as a critical infrastructure. SofNS is responsible for its management. The radiation monitoring network operates in two modes. The first mode, so-called common monitoring, is focused on monitoring during normal radiation situation; the second mode, so-called contingency monitoring, is focused on monitoring in case of an accidental exposure situation. In the Czech Republic, the monitoring of the radiation situation is performed by: early warning network[38], the TLD territorial network, TLD local network in the vicinity of Temelín NPP and Dukovany NPP, network for internal exposition and territorial and local network of environmental sampling. An important component of the radiation monitoring network is the network of monitoring routes provided by mobile groups. The Army of the Czech Republic is also involved in the monitoring of radiation situation. Military radiation monitoring network includes an early warning network[39] designed for continuous activities, which includes the monitoring of radiation and nuclear events, the collection, evaluation and transmission of information about the possible use of nuclear weapons of mass destruction and the occurrence of radiation accidents. An integral part of the military radiation situation monitoring system is also aerial radiation monitoring.

In the Czech Republic, a total of 6 power generation units with VVER reactors are currently in operation, namely the Temelín NPP (2 reactors) and the Dukovany NPP (4 reactors), owned and operated by the company ČEZ. Both of these NPPs, including data centers, control panels, power plants, electronic communications networks, and control and safety systems, are designated as critical infrastructures. Furthermore, two research reactors are operated in the Czech Republic in the Řež Research Center and one school reactor is located at the Czech Technical University - Faculty of Nuclear Sciences and Physical Engineering[40]. Radioactive waste repositories are also considered to be nuclear facilities, with the Radioactive Waste Repository Authority[41] being responsible for their operation.

The safety of both NPPs and other nuclear reactors in the Czech Republic is considered to be of utmost importance. The safety of a NPP is achieved by the quality of the project and the level of operational culture which includes qualified and cleared personnel[42], high quality documentation and usage of operational experience, technical inspection, radiation protection, fire safety and more. The level of safety is constantly being improved by technical design and safety measures so that it meets all the requirements for the current operation of NPPs. For example in the Dukovany NPP, the number of backup diesel generators was increased from 12 to 18 for the case of complete power loss. Because of this, the Dukovany NPP belongs among the 20 % of the best-operated NPPs in the world, according to the standards of the World Association of Nuclear Operators.

[36] It deals with specialized activity in the field of population protection against ionising radiation. The Institute mainly performs research on protection against ionising radiation, including provision of the research infrastructure in the fields of security research, radiation monitoring network research and research of artificial sources of ionising radiation exposures (mainly from nuclear facilities), research of medical exposures and research of natural sources of ionising radiation. The Institute also ensures the activities of the radiation monitoring network, the activities of the mobile group for the analysis of radiation accidents and emergency events in the field, the systematic search for buildings with increased radon concentration and other expert activities.

[37] The Institute deals with identification, quantification and definition of nuclear, chemical and biological substances and evaluation of their effects on the human and the environment including evaluation and development of individual and collective equipment for population protection against these substances, further decontamination and safety research in the scope of fight against terrorism and serious industrial accidents.

[38] This network consist of 169 measuring points that are placed at sites of regional centres of SofNS, State Institute of Radiation Protection, CHMI, FRS and Army of the Czech Republic.

[39] It consists of 17 measuring points and central and backup station.

[40] SofNS issued the permission to place reactor VR-2 at the Faculty of Nuclear Sciences and Physical Engineering. New facility is designated to the education of the specialists, as well as experts of International agency for nuclear energy and others universities. According to the expectations, the new reactor should be in operation in 2022. Then the number of nuclear reactors in the Czech Republic will rise to 10.

[41] It performs the tasks concerning safety deposition of radioactive waste produced in the past and in the future in accordance with requirements on nuclear safety and radiation protection of population and the environment. It operates the repository of radioactive waste, coordinates preparation of underground repository construction and controls if the waste designated to deposition meets the norms set by SofNS.

[42] Each employee of NPP that has the right to enter e.g. the block or emergency control room or both containments needs personnel security clearance of NSA. This is also mandatory for the employees of NPP suppliers. In both NPPs, there are ca 1 916 employees and 1 000 employees of suppliers with personnel security clearance. In addition, there are other security components installed and further regime provisions are established.

The basis for ensuring nuclear safety consists of multiple safety emergency systems (emergency shutdown system, emergency core cooling system, shower system for pressure suppression in the containment, auxiliary water system, emergency power supply system, etc.) that ensure safe shutdown of the reactor. Protection against the release of radioactive substances into the environment is implemented on the principles of so-called deep protection with multiple physical protective barriers consisting of:

- solid ceramic structure of fuel,
- hermetic coverage of nuclear fuel,
- enclosed nuclear (primary) circuit,
- containment (reinforced concrete protective container), which performs two basic functions:
    - protects the vicinity of the NPP from the consequences of a possible radiation emergency event,
    - protects the reactor and other components of the primary circuit from external influences.

In addition to the readiness for resolving radiation accidents at NPPs, the Czech Republic also focuses on its preparedness to manage all types of radiation emergencies that can occur on its territory. This can be for example an accident during the transport of radioactive substances, an explosion of a so-called dirty bomb (explosives contaminated with radioactive substances), and the dispersion of radioactive substances from an abandoned, lost or stolen radionuclide source. Such radiation emergency events can cause impacts that will have to be managed by necessary measures to protect the health of the population outside the designated emergency planning zones (around the Temelín and Dukovany NPPs).

Planning documentation and preparedness for radiation accident management

Model action plan "Radiation Accident" sets out procedures, principles and measures for resolving a radiation accident. This plan sets out measures for the protection of the population during a crisis situation; special cards are prepared for each measure, namely: Evacuation in the event of a radiation accident; Iodine prophylaxis; Emergency monitoring of the radiation situation; Sheltering. All these measures are further practically elaborated in the crisis plans of the regions part of whose territory belongs into the emergency planning zone of the NPP. The measures of the NPP operator for possible emergency events are described in more detailed documentation, but only a very limited number of cleared personnel has access to it.

Internal contingency plan is compiled by the permit holder/NPP operator (ČEZ), who also performs an analysis of possible causes of a radiation accident. This plan is intended only for the premises of a nuclear facility or workplace with sources of ionizing radiation.

External contingency plan is elaborated for the vicinity of the nuclear facility, more precisely for the defined emergency planning zone. It is a basic document for setting the measures to protect the population, the environment and property in the event of a radiation accident. The regional FRS in whose territorial district the nuclear facility is located, is responsible for its compilation.

National Radiation Contingency Plan is a strategic document with the focus on the whole territory of the Czech Republic outside of the emergency planning zones (around the Temelín and Dukovany NPPs), which are covered by external contingency plans. This plan is intended as a preparedness plan for the coordination and response to radiation emergency events in the Czech Republic (only emergencies with impacts outside of the emergency planning zone). It is compiled by the SofNS in cooperation with the MoI. The draft of the plan is in the approval process[43] at the time of writing of this document.

Emergency planning zones in the vicinity of the Dukovany and NPPs were designated by SofNS based on analysis of potential impacts of radiation accidents. The emergency planning zone of the Dukovany NPP has a radius of 20 km and the emergency planning zone of Temelín NPP has a radius of 13 km. The emergency planning zone is an area where urgent protective measures (sheltering[44], iodine prophylaxis and evacuation) are prepared in advance for the possibility of a radiation accident occurrence.

[43] The obligation to compile a National Radiation Emergency Plan is one of the requirements of nuclear legislation. In cooperation with the MoI, SofNS is obliged to prepare this plan and have it approved by the Government of the Czech Republic within 4 years since the novelised Atomic Act came into force (e.g. by the end of 2020).

[44] Emergency sheltering is limited to 2 days and evacuation is not expected to exceed the period of 7 days. If the evacuation lasts longer than 7 days, it is then replaced by protective measure of population displacement.

According to the Atomic Act, the operator of a NPP is obliged to provide basic information to the population within the emergency planning zone of a NPP for the event of a radiation accident and update[45] this information regularly. Information may be provided or updated only with the approval of the SofNS, FRS and the regional governor. In addition to providing information, the NPP operator is obliged to equip (in cooperation with the relevant regional authority or FRS) the population and IRS forces (which would intervene in the emergency planning zone) with antidotes for iodine prophylaxis.

The company ČEZ as a private entity and operator of NPPs in the Czech Republic plays a significant role in population protection, emergency preparedness and preventive educational activities in emergency planning zones of NPPs[46] (ČEZ financially supports e.g. projects for the purchase of mobile sirens, measuring instruments and dosimeters, multimedia classrooms and a trailer for the protection of the population).
Within the process of modernization of the warning system for the population in emergency planning zones of NPPs, ČEZ is also implementing a project to substitute existing rotary sirens and original first generation electronic sirens with modern electronic sirens suitable for newly built digital infrastructure and two-way communication.
The operator of a NPP is also obliged to evaluate the accuracy, efficiency and mutual compliance of the internal contingency plan and the external contingency plan and their compliance with the National Radiation Contingency Plan by the means of exercises. The resolving of a radiation emergency event in the emergency planning zone is verified by the ZONE[47] exercises, which are performed according to the external contingency plan. The participants of the exercises are the operator of NPP, the regional authority, the IRS[48] units, other bodies and organizations included in the external contingency plan and the SofNS. The last ZONE exercise took place in 2019 at the Temelín NPP and focused on resolving an emergency event connected with a simulated radiation accident at the NPP.

The Czech Republic also participates in international exercises organized by European Commission (ECUREX[49] exercise), the International Atomic Energy Agency (ConvEx exercise), the Nuclear Energy Agency under the Organization for Economic Co-operation and Development (NEA OECD, INEX exercise), and others.

Radiation accidents can cause damage to the lives and health of population, the environment, the economy, the critical infrastructure and they can also have international impacts. Direct effects of a radiation accident on the territory of neighbouring states are not expected. In the event of a radiation accident in the Czech Republic, depending on its course and the extent of the contaminated area, indirect impacts may occur, including disturbances or restricted trade activities, transfer of goods and commodities, and regulation of international traffic in order to limit the spread of radioactive contamination.

The Czech Republic is a signatory to the Convention on Early Notification of a Nuclear Accident and the Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency. With regard to these conventions, the SofNS acts in relation to the International Atomic Energy Agency as the National Competent Authority for Emergency Abroad / and Domestic Emergency, and acts the same way in relation to the neighbouring states. The function of National Warning Point is held by the DG FRS through its Operations Centre. It is the duty of the states that have ratified these conventions to timely warn those states that could be endangered by a radiation accident and to provide appropriate assistance upon request.

In the highly improbable case that a radiation accident should occur in the Czech Republic, SofNS would propose the activation of the Central Crisis Staff and the declaration of a state of emergency in the contaminated area after receiving a notification of the occurrence of a radiation accident from the NPP operator. SofNS would also issue a proposal for the implementation of protective measures and provide preliminary information to the population, initiate emergency monitoring, declare alert for mobile groups (including their activation), activate aviation monitoring groups and evaluate the data in terms of forecasting further development of radiation situation. Relevant ministries, the FRS, Police, the Customs Administration

[45] Information Centres of both NPP plays important role in the public awareness. NPP Dukovany annually issues calendar with population protection handbook that is approved by SofNS. Similar handbook is issued by NPP Temelín.
[46] Based on the strategic agreement on cooperation signed by ČEZ, DG FRS, FRSs of South Moravian Region, South Bohemian Region and Vysočina Region (regions where NPP Temelín and Dukovany are located).
[47] It is organised once in two years alternatively in NPP Dukovany and NPP Temelín.
[48] FRS and fire brigades ensuring area fire protection, Emergency Medical Service, Police.
[49] In 2019 the Czech Republic was the host country. The initial situation for the exercise was simulated as an accident of NPP Dukovany that caused partial melting of nuclear fuel and subsequent leakage of radioactivity to the vicinity of a nuclear facility.

of the Czech Republic, regional authorities, municipal authorities and other bodies would also participate in managing the radiation accident in accordance with the Atomic Act, other legal regulations and crisis and contingency plans, in order to fulfil requirements for protective measures for the population. After the termination of the radioactive substances release, based on the results of radiation monitoring, the contamination of the affected area would be delimited into zones with a specific designation:

- Danger zone - an area in which permanent residence of the population is excluded. Entry is allowed only to persons involved in the implementation of corrective measures and ensuring the monitoring of the radiation situation. In this area, the reference level of the planned effective dose may exceed ≥ 100 mSv / year.
- Restricted access zone - an area in which the necessary protective measures must be in place to stay outdoors and ingest contaminated food. In this area, the reference level of the planned effective dose may be ≤ 100 mSv / year ≥ 20 mSv / year.
- Zone with controlled residence - an area in which sufficient protection is provided for individuals who comply with the recommended measures in the area of regulation of the consumption of local agricultural production. The sum of the planned effective dose and the effective dose duration shall not exceed 20 mSv / year.

Ensuring nuclear safety is one of the highest priorities in the Czech Republic. Nuclear safety means "the condition and ability of a nuclear installation and persons operating it to prevent uncontrolled development of a fission chain reaction or the release of radioactive substances or ionizing radiation into the environment and to mitigate the consequences of accidents." Nuclear safety requirements are met in all phases of the life cycle of the nuclear installation: placing, construction, putting into operation, operation and decommissioning, but also in the radioactive waste or the spent nuclear fuel management. For each phase of a nuclear installation, the applicant / permit holder / operator submits the documentation containing a safety assessment confirming the required safety level to the SofNS. The basic safety goal is to protect people, society and the environment from the adverse effects of ionizing radiation. The basic principles that are implemented in all projects of modern NPPs include thorough protection, safety categorization, classification and qualification and regular safety assessment throughout the service life. Owing to the constantly improving technical design and multilateral safety measures, Czech NPPs are currently one of the safest technical facilities in the Czech Republic.

3.2.3. Large-scale disruption of food supply

Water and food are one of the basic human needs and provision of food is also one of the key factors of global progress. We cannot fully secure economic, social, political or global stability without stable, safe and economically effective approach to food and resources for their production. Provision of food also represents an important political and security issue.

Significant disruption of food supply on the territory of the Czech Republic is highly unlikely during peace time due to existence of sufficient amount of fertile ground, pastures, orchards, forests, number of food production businesses, number of farms, solid network of wholesalers and corresponding warehouses. Nevertheless, significant disruption of food supply can appear as a secondary consequence of other emergencies such as floods, prolonged extreme drought, shortage of drinking water for food production, prolonged disruption of energy supply, disruption of transport, occurrence of widespread epidemics and epizootics, technological accidents and terrorism.

The duration and territorial extent of food supply disruption would depend directly on the impact, duration and extent of measures used to resolve the above-mentioned emergencies. According to current experience, possible occurrence of crisis situation is limited to territories threatened by floods, special floods or on the territory with large population concentration caused by evacuation from endangered areas.
Concerning basic commodities such as meat, milk, cereals and sugar, the food is primarily produced from domestic resources. An important pointer in the area of food supply is also foreign trade (agricultural import and export).

In the Czech Republic, a state of crisis due to significant disruption of food supply hasn't been declared yet. During such crisis, impact on lives and health of population and environment would be expected. It could also cause economic, social and international impact and disruption of critical infrastructures. Lives and health of population can be threatened by contaminated food consumption, insufficient hygiene during food production and consequent epidemic outbreaks or mass spread of disease. Food supply disruption can also cause other problems. Prolonged food shortage can lead to panic, looting and widespread social unrest. Last but not least, it can lead to contamination of soil, water reservoirs, watercourses and sources of drinking water used for food production. Furthermore, it can lead to increase of waste and waste water from food production, spread of odours from spoiled and contaminated food (air pollution) or the malfunction of wastewater treatment plants near damaged food production facilities. Long term illnesses caused by malnutrition, deaths, spread of panic, chaos, violence, deterioration of mental health and increase of stress can cause further social consequences.

Economic impacts can be caused by disruption of food production facilities, disruption of food production by destruction of food production technologies, destruction of resources used for food production or by exorbitant cost of emergency supply to the affected population. Concerning international impacts, this crisis can lead to deterioration of international relations, deterioration of relations with similarly affected countries (caused by competition for food resources), disruption of food export and it can also complicate situation concerning food import. In the area of critical infrastructure, it can lead to disruption of activities of administrative authorities, educational, health, social, accommodation and other facilities and to disruption of their operation.

Food industry and agriculture is one of the sectors of the national critical infrastructure. Critical infrastructures can be designated in the area of crop and livestock production and food industry production. Critical infrastructure operators are obliged to perform a number of duties for securing the continuity of their operation.

Dealing with the crisis is usually the responsibility of the regional governor and regional authority. Regional governor is authorized to declare state of danger and coordinate emergency food supply on the territory of the region. In this case, emergency food supply is coordinated by regional crisis management authorities in cooperation with other responsible authorities for a necessary time period until the recovery of a normal food supply. Emergency food supply is secured by necessary deliveries which can be obtained within the system of emergency economy. In case of extensive crisis when shortage of resources and food is nationwide, the government would declare state of emergency and all administrative authorities would be coordinated by Central Crisis Staff.

Ensuring the emergency supply of food and drinking water is one of the main objectives of the emergency survival system, used for maintaining the health and basic necessities of the population in the area affected by the emergency. Emergency survival measures also include emergency power supply, emergency accommodation and humanitarian aid. Emergency food supply is carried out to secure basic nutrition for population; for achieving this objective, distribution network, contracted entities and partially also humanitarian aid can be used. Catering can be provided with the help of regular catering facilities, mobile catering facilities and canteens (list of these facilities can be found in the annex of the population emergency survival plan which is part of regional contingency plans). Within emergency catering system, the amount and choices of meals, groceries and drinking water would be limited to accommodate the basic needs.

Emergency food supply is also addressed by Act on Economic Measures for Crisis Situations[50], where regulatory measures are defined. These measures are used for decreasing consumption and allocation of scarce resources (regulation of production – mandatory production of basic food items, prohibition of export and rationing). In case of large-scale crisis, material reserves allocated at AaSMR facilities can also be used. Basic food commodities are bought on the basis of MoA and MoD requests. Currently, these reserves are created for 1.3 day of normal consumption (13 million portions). These reserves consist of frozen meat, canned food, butter, dried milk, grain, cheese, sugar, salt, etc. Czech Republic is largely self-sufficient in the area of food provision and larger shortage of food commodities is not expected. Material reserves should thus serve for coverage of initial food shortage in the affected territory until the food supply is restored. Most of above listed commodities are stored in the warehouses of external suppliers that are obliged to always have fresh food items according to their contract (e.g. dried milk must not be older than 10 months, processed cheese must not be older than 60 days).

Procedures, principles and measures for resolving this emergency are outlined in the model action plan "Large-Scale Disruption of Food Supply". This plan serves as a basis for crisis plans, where the specifics of food supply disruption are incorporated into the procedures for dealing with the crisis.

Basic tools for resolving this emergency are efficient legislation and corresponding international agreements along with prepared measure to prohibit food export, humanitarian aid and importing food from unaffected countries with the help of embassies. When the food emergency food supply system is activated and regulatory measures concerning food distribution applied, it is also important to inform the population in the affected territory about relevant procedures and measures.

To ensure food supply, it is important to interconnect measures of regional and state authorities responsible for dealing with food production, necessary deliveries of food items and their distribution to the affected population. The following measures can be used: ordering an increase of production of existing production facilities, securing sufficient amount of resources for food production, ordering production of limited range of basic food items, commissioning an additional existing production capacity, securing import of food items and resources from unaffected countries, prohibition of export of food items and resources. As a last resort, it may be necessary to declare regulatory measures not only within the production system but also by establishing a food rationing system.

To appropriately prepare for the emergency, it is crucial to perform a thorough analysis of the threatened territory showing, among other things, the number of population that will need to be provided with basic food, the requirement for continuous situation monitoring, timely response and mitigating the impacts of the crisis.

Conclusion

This report was compiled by DG FRS using background information and documents from other relevant authorities, namely MoE, MoA, MoH, MoIaT, and other experts both on central and regional levels. Through this activity, the Czech Republic attempts to participate in the development of transnational disaster management policies and procedures and promotes the necessary information sharing between relevant administrative levels of the Member States participating in the Union Civil Protection Mechanism.

[50] Act no. 241/2000 Coll., on economic measures for crisis situations

List of Abbreviations

AoSMR – Administration of State Material Reserves
CEC – Central Epidemiology Committee
CHMI - Czech Hydrometeorological Institute
CNB – Czech National Bank
CPHO - Chief Public Health Officer of the Czech Republic
CTA - Czech Telecommunication Authority
DG FRS – Ministry of the Interior - Directorate General of the Fire and Rescue Service of the Czech Republic
FRS – Fire and Rescue Service of the Czech Republic
GIS - Geographic Information System
IRS - Integrated Rescue System
JWNS - Joint Warning and Notification System
MFA – Ministry of Foreign Affairs
MoA – Ministry of Agriculture
MoD – Ministry of Defence
MoE - Ministry of Environment
MoEYS - Ministry of Education, Youth and Sports
MoF - Ministry of Finance
MoH - Ministry of Health
MoI – Ministry of the Interior
MoIaT – Ministry of Industry and Trade
MoJ - Ministry of Justice
MoRD - Ministry of Regional Development
MoT - Ministry of Transport
NCISA – National Cyber and Information Security Agency
NPP – nuclear power plant
NSA - National Security Authority
REC – Regional Epidemiology Committee
RPHA – Regional Public Health Authority
SofNS – State Office for Nuclear Safety
TLD - thermoluminescent dosimeters