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Risk Analysis of Crisis Management on the Example of Rural Areas in Poland

Dariusz Masłowski *

Faculty of Production Engineering and Logistics, Opole University of Technology, 45-758 Opole, Poland

* Corresponding author. E-mail: d.maslowski@po.edu.pl (D.M.)

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ABSTRACT: The aim of this article is to analyze and assess the risk of crisis hazards and to introduce possible improvements on the example of the Municipality of Branice. The types of threats and the consequences associated with their occurrence are also described. The quality management method (FMEA) was used to develop the risk assessment, as well as an indication of the risk values presented by the risk matrix made. Thanks to the research part of the study, the most probable possible risks and their consequences were detected, and improvements were proposed to prevent the occurrence of such situations in the future. The main conclusions of the study are: (1) a properly prepared crisis management plan is the most important and effective method to deal with emergencies that threaten the life and health of citizens; (2) hazards have been, are, and will continue to accompany people, so adequate preparation is needed to minimize their effects or even eliminate them altogether; (3) during the occurrence of an emergency, the sphere of logistical action is very broad and determines the methods and actions of the relevant services in order to reduce the effects of the threats that occur; (4) the conducted analysis of threats possible to occur in the area of Branice Commune indicates that the highest probability of occurrence of a threat is floods and waterlogging as well as hurricanes and strong winds; (5) the conducted FMEA analysis indicates that a very important factor preventing the creation of the threats discussed in the point above are periodical inspections and cleaning or modernization works of the given threat areas. In summary, the FMEA analysis showed that in the analysed municipality, the most serious risks were flooding and flooding, as well as hurricanes and high winds. The following remedial actions are proposed in the analysis and to improve these areas in the rural areas: water surge in the riverbed (cleaning of the riverbed; repair of dikes; securing roads and communication bridges against possible damage; securing drinking water reservoirs against pollution; securing sewage treatment plants against possible leakage of faecal matter into flood waters); obstruction of field drainage (regular mowing and cleaning of ditches; checking the patency of ditches; roofs of residential and commercial buildings and fallen trees in villages close to houses (inspections and pruning of dangerous tree branches and possible removal of trees threatening danger of falling; inspection of roof structures by building supervision) and fallen trees in riverbeds (cleaning of banks and riverbeds; inspection of tree stands near rivers). The policy implications of this study may be far-reaching, not least because it may determine rural managers to change their management and attention to and response to crisis threats that may occur in such areas. Regarding the limitations of the study, it is important to remember that it was conducted on the author's chosen terrain. In most cases, changes in the terrain, the population or its management have a determining influence on the shaping of emergency response principles. Therefore, the study conducted should provide an overview of the research issue undertaken. In the future, it is planned to extend the study area to equal rural areas occurring in the world, and it is also planned to verify the existing hazards on the ground on a continuous basis. In addition, it is intended to extend the deeper cooperation with both the rural authorities and the rescue units in order to imply the research results in the actual territorial units.

Keywords: FMEA; Risk management; Rural areas; Crisis management; Humanitarian logistics

1. Introduction

Risk management is used in many areas of state activity, in relation to different types of state sectors [1]. When thinking about an emergency situation, human security always comes first. It provides a sense of certainty, as well as a guarantee of its preservation. The mental state of a person free from fear makes him or her a person who enjoys every day, every moment and does not feel threatened [2]. However, this state is not permanent, as it is possible for unpredictable situations to occur and shatter the previous harmony.

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During a state of threat to human life, property or the environment, logistics plays an important role in emergency situations [3]. Logistics activities in non-military crisis situations are undertaken on a priority basis for the benefit of the affected population [4,5]. In the first instance, these activities are directed at saving human life and health, followed by the pro-cissing of supplies and services to the affected population to meet their elementary needs in accordance with the general tasks of logistics, i.e., right time, right place, right form, and right quantity [6].

Risk management is a complex process, where new techniques and research methods are used and developed [7]. The choice of each depends on the area being analyzed and the stage of risk management being implemented at the time [8]. The first and most important step in the risk estimation process is to define all possible sources of risk as potential damage, which refers to the state of awareness of the perception of unfavorable or dangerous phenomena by a given social group. When defining the risks, all possible available knowledge in the field of hazards should be used, and it should be checked whether the collected materials and sources of information are sufficient [9]. Risk management methods fall into three basic groups: qualitative, quantitative, mixed [10].

The ability to manage risk is to carry out appropriate assessments. The concept of risk assessment is called the process of identification, analysis and estimation. Identification is introduced in the case of natural disasters and catastrophes that have negative consequences for people, the environment or property. The second process, risk analysis, measures the analysis of previously identified risks. The final process is risk estimation, i.e., indicating to what extent a given risk is acceptable to the regional authority. Risk management is essentially an ongoing or continuous process, and should be continually refined as standards in strategic management change. Risks are influenced by external and internal factors. External factors do not depend on decisions taken by individual units, but on the situation found at the rescue site, including the scale of the emergency, sudden weather changes, the lack of a major commander or insufficient number of rescue services. Internal factors include problems within the unit, such as a lack of appropriate equipment, staff shortages and inadequate management of the unit. It is important to note that factors will vary and differ in terms of the magnitude of the risk and the number of emergency services required.

Crisis management consists of responding to, preparing appropriate forces and resources, recovering from and restoring resources needed to prevent emergencies arising from technical failures or natural disasters [11]. Crisis management is one of the specific types of management characterized by [12]:

- limited time,
- working under time pressure,
- lack or excess of information,
- uncertainty of decisions taken,
- decision-making process with time constraints.

The importance in crisis management has a significant impact on the management of people, through simple and understandable commands, the presentation of values and courses of action during an action, which aim to unite all participants. Such activities should make the organization and exchange of information unambiguous and crucial to the final outcome. The importance and impact of the above is to be effective when it requires the interaction of more services, institutions and the population.

The main task of logistics during emergencies is to provide forces and resources to help those affected and to combat the effects of the situation, in order to ensure safe survival conditions for those affected [13]. The main objective, on the other hand, is to increase the level of safety and effectiveness of operational activities and to meet, as far as possible, the current needs of the affected people and their property, as well as the environment in the territory of the disaster. The tasks of logistics during emergency operations are [13]:

1. providing first aid to injured persons to save human life and health.
2. carrying out evacuation and transportation activities by law enforcement and rescue services.
3. providing assistance to affected persons to meet their material and non-material needs.
4. to establish and maintain temporary accommodation in the situation of evacuation of the affected persons in a wide range.

Logistics support in emergencies is also referred to as ‘humanitarian logistics’ due to the relief of people in the first instance [14]. It supports the handling of the logistical security of the affected population and supports the improvement of people’s living conditions in the shortest possible time, while maintaining the highest standards of safety and efficiency of all logistical processes [15].

There are many hazards that can occur in municipal, national or even global areas [16]. The causes of any hazard are usually human, natural or technical agglomeration failure [17]. However, the effects of the resulting hazard are

invaluable until it is contained and completely neutralized. Any state of emergency that threatens human life and health, property and the environment is a crisis situation for a given society. The causes and effects of any emergency event are different and will never be the same although they may be similar.

- Flooding and waterlogging:

When describing the phenomenon of flooding or localized flooding, the causes can be many and varied, starting with heavy rainfall, inadequate drainage networks, failure of water supply networks, destruction of road and field drainage networks through backfilling of ditches or prolonged rainfall which raises the water level in local rivers, streams or ditches. The above-mentioned causes of the resulting threat of flooding or waterlogging are created by man—by destroying the drainage of roads and fields, by nature—through changes in weather conditions, and by technology, which sometimes fails. Man has no direct influence on flooding, as it is a natural phenomenon beyond his control. He does, however, have an impact on its effects, which, through appropriate processes and techniques, can be controlled in some way [18]. The consequences of flooding and waterlogging can be: damaged natural environment, destroyed residential and economic buildings, destruction of tourist sites, financial and material losses, loss of human life or health, as well as by economic and domestic animals, moral, economic and environmental losses.

- Fire:

The causes of fires as well as floods are man, nature and technical failure. If any one of these factors fails, there is a risk of fire, which spreads uncontrollably, making it difficult to work on its containment. Fires pose many dangers to victims, rescuers, onlookers and the natural environment. When differentiating between internal and external fires, it is important to know that internal fires involve the risk of loss of health or life through smoke from burning equipment or building structures creating chemical compounds that prevent breathing and burn the respiratory tract, as well as direct exposure to fire that creates burns and weakens the structure of the building with the risk of collapse. With external fires, fire smoke in landfill areas and contaminated areas is particularly dangerous. There is also a high risk of fire development depending on the prevailing weather conditions. The most dangerous, however, are fires involving explosives and chemicals. There are also fires on means of transport such as cars, buses and motorbikes. They pose a direct threat to human life and health, as well as to the environment [19]. The consequences of fires include: burns, loss of health or life, changes to the environment, financial, material, moral losses, total destruction of residential or business premises.

- Hurricanes and strong winds:

The phenomenon of hurricanes and strong winds is a very dangerous natural factor. It is determined by atmospheric factors beyond human control and cannot be prevented in any way. The consequences of hurricane-force winds can be broken and damaged roofs of residential and commercial buildings, downed telecommunication lines and power grids, fallen trees, damage to the natural environment, financial and material losses, and possible loss of life and health [20].

- Frost and snowfall:

Severe frost and heavy snowfall are also dangerous factors causing extreme hypothermia. They are conditioned by atmospheric factors beyond human control. However, people can protect themselves from the cold to a certain extent by wearing suitable outer clothing and by eating warm meals. The consequences of intense frost and snowfall include disruptions to land, air, and even inland and maritime transport, breaches in the roof structures of dwellings and outbuildings, the risk of collapse, problems in providing assistance to those in need, power cuts, and possible problems in the supply of water, food or heat. The extreme consequences of these weather phenomena are frostbite to the extremities, as well as the possibility of loss of life and health through inadequate precautions [21].

- Drought and heat:

The phenomenon of drought as well as heat depends solely on the prevailing weather conditions. This can be caused by low snowfall in winter, low rainfall and high temperatures in summer. These three factors cause a drop in groundwater levels and thus drought. The effects of drought include: low crop yields, low groundwater levels resulting in interrupted water supply, drying up of surface water bodies as well as lowering of water levels in river beds, destruction of natural fauna and flora, and partial extinction of aquatic animals. Among people, especially the elderly, sunstroke is possible, causing death or partial disability.

- Chemical and biological contamination:

Human or technical failure is primarily responsible for this type of accident. The causes of chemical or biological contamination may be improperly stored waste, leakage of such waste into groundwater or rivers, the possibility of such

waste entering the environment during a traffic accident transporting such waste, or technical failure of the machinery handling such materials. The consequences of chemical and biological contamination include the destruction of the natural environment and the extinction of animals in the area, as well as a threat to human life and health through the penetration of harmful agents into the soil on which crops will be grown and drinking water reservoirs [22].

- Risks associated with the occurrence of radiation events:

The danger of a radiation event exists at the site of an activity involving ionizing radiation sources, nuclear materials or radioactive substances [23]. The types of biological effects of radiation are [24]:

A. Somatic effects—early-phase effects are, for example, radiation sickness or blood lesions, while late-phase effects are leukemia, skin and bone malignancies, infertility, gastrointestinal disorders, cataracts or growth and developmental delays;
B. Genetic effects—small doses of radiation cause mutational changes in subsequent generations of the irradiated person, while high doses cause direct death to the fetus or death in its early development.

- Epidemic risk:

Epidemics of infectious diseases among humans can occur worldwide. There are many diseases in the world that can turn into epidemic form. The most common epidemic in the world is the influenza epidemic. The influenza virus, through its mutations, contributes to the deaths of millions of people worldwide and causes epidemics or pandemics through its rapid spread by the droplet route. Over the last century, mutations of the influenza virus contributed to the worldwide declaration of the Spanish flu, Asian flu and Mexican flu pandemics, which contributed to the deaths of millions of people [25]. Another pandemic was triggered in 2020 by the COVID-19 infectious disease and, to date, the epidemic situation worldwide is difficult to control, as the SARS-CoV-2 coronavirus, like the influenza virus, spreads dynamically by the droplet route. The symptoms of COVID-19 are very similar to those of influenza, but in addition include loss of taste and smell and severe lung failure.

- Threats to fuel security and disruption of electricity, heat and water and gas supply:

The global fuel security situation is at a very good level. It could only be destroyed by armed conflict, the likelihood of which is rather unlikely. Disruptions to the supply of electricity, heat, water and gas exist only during failures of the network supplying them and the points generating such energy or drawing points [26,27]. These interruptions can be caused by a technological failure, a terrorist attack or sanctions imposed by the country exporting the service in question. The consequences of the above threats can include temporary interruptions in the supply of these goods, traffic disruptions, lowering of sanitary standards, disorder and many others.

- Transport and construction disasters:

The risk of road or building disasters exists worldwide almost all the time. Such incidents are mainly caused by human beings or technical failures, for which humans are also responsible. Traffic disasters carry the risk of paralyzing transport services, causing material and moral damage as well as loss of life or health.

- Animal disease risk:

Animal diseases, like human diseases, can be infectious, viral or degenerative. They can be dangerous and only develop in one group of animals as well as spread between groups of animals and can also transmit to humans. The health of livestock such as pigs, cows, ducks and chickens, which are a source of food, is particularly important. Livestock diseases can contribute to significant increases in economic costs and huge financial losses for livestock owners [28].

- Threat of plant disease

Plant diseases can occur throughout the country and their type and severity depends on the intensity of the specific crop. All prolonged disorders of plant development are caused by pathogens [29]:

  - non-infective involving, for example, the whole crop area: atmospheric—high temperatures, lack or excess of rainfall; soil-related—soil Ph reaction, type, deficiency or lack of nutrients;
  - infectious arising, for example, in the middle of the crop between healthy plants. Causes of this type of disease are: viruses and viroid's; phytoplasmas; bacteria; fungi; parasitic seed diseases.

The consequences of the threat of plant disease are, for example, an increase in food prices and a decrease in agricultural production.

- Terrorist threat

The threat of terrorism can occur throughout a country. In recent years, the number of attacks as well as the number of victims has been steadily increasing, which means that the risk of terrorism is the greatest contemporary threat to the whole world. The phenomenon of terrorism is defined as: "...the planned and organized actions of individuals or groups attempting through the use of violence, cruelty, intimidation to extort certain concessions, benefits from governments of states and societies..." [30]. Terrorism can be political in nature aimed, for example, at changing the political system or the ruling elite, or criminal in nature usually acting for material motives.

- Failure of ICT networks

Nowadays, IT networks are operated continuously, so it is a necessity to ensure that they are adequately protected depending on their importance to the organization. According to K. Liderman, a computer network threat is defined as: "...a potential breach in the security of an information system" and "a vulnerability is a flaw or gap in the physical structure, organization, procedures, personnel, management, administration, hardware or software that can be exploited to cause damage to an information system or human activity" [31]. Threats exist:

- external through which a computer network can be damaged resulting in industrial disasters, civil unrest, loss of data or changes in network management controls;
- internal—"...when there is or has been the possibility of loss of the ability to operate the information and communication network, as a result of intentional or accidental action by unauthorized persons acting in the external environment of the network...";
- physical—destruction of the IT network, equipment and facilities due to natural disasters or intentional human actions [32].

The consequences of ICT network failures are the inability to transmit information or make cashless payments.

- Strikes, riots and demonstrations

Analyzing the definition: "Strikes, demonstrations and the resulting riots (revolts, revolts) were an enduring and visible feature of the social and political landscape of the 20th century and continue to be so. They have become a customary, almost every day, means of collective expression and defense of interests" [33], it can be understood that such threats can arise throughout the country and be local or general in nature. They can be caused by social discontent with the exercise of power by the political parties in operation, by racial, religious and ethnic riots, or by mass dismissals of workers in a given workplace. The consequences of this type of threat usually include devastation and destruction of property, high material losses, communal and administrative paralysis and even a threat to the life and health of local residents.

In view of the above analysis, the following research formulations can be posed for the realization of this article, which would illustrate the desirability of carrying out the study. The research problem was presented in the form of questions:

- Which crisis hazards are present in rural areas?
- Which of these hazards are the most dangerous?
- What countermeasures should be taken to counteract the crisis threats that are present?

The following research methods were used to address the research problem:

- analysis of hazards occurring in the study area—observation method, analysis of source data made available by municipal authorities and emergency units,
- risk analysis—the FMEA method,
- and, in addition, comparative methods, literature research methods

Therefore, the aim of this study is to analyze and assess the risks of crisis management as well as to identify possible improvements on the example of the Municipality of Branice, Poland. The performed risk analysis, together with the level of acceptance, indicates the possible threats to occur in the area of Branice Commune, as well as the interdependence between the probability and effects of threats. The situations included in the Crisis Management Plan for the Municipality of Branice were analyzed on the basis of the rescue, fire-fighting and search activities carried out in the area. The research carried out ran from 2018 to 2023 and covered a wide spectrum of hazards occurring in rural areas. In many cases, the data made available was immediately processed for presentation in the article, while some of it was taken from historical data made available by rescue units.

2. Materials and Methods

2.1. Risk Analysis

It is the duty of every government to ensure the safety and security of its citizens' lives. This is also the duty of every employer, as well as the person in charge of rescue operations and management during an emergency. An equally important aspect is to inform subordinates and possible victims of the current and possible level of risk. In this connection, an assessment of the safety of the work and the environment in which the human safety work or the environment will be carried out is carried out. This is done by identifying and assessing the risks associated with the situation. The result of such an assessment enables effective steps and measures to be taken to reduce or completely eliminate possible risks [34]. In order to perform a risk assessment in an appropriate manner, it is possible to use methods of one's choice, which will, however, be appropriate to the assessment of the emergency situation in question, the activities to be carried out, the type of technology to be used and the like [34].

Classification of impacts in an analogous way, but takes into account the category of risk to life and health, loss of property and environmental impact. As a first step, the likelihood of a hazard occurring must be identified (Table 1) and its effect determined (Table 2).

Table 1. Probability scale [35].

Scale	Probability	Description
1	Very rare	Can only occur in exceptional circumstances. May occur once every five hundred years or more.
2	Rare	They are not expected to happen. They may occur once every hundred years.
3	Possible	It may happen by chance at a particular time. It may happen once every twenty years.
4	Likely	Likely to occur in most circumstances. It may occur once every five years.

Table 2. Scale of effects and their characteristics [35].

Scale	Impact	Category	Description (Z—life and health, M—property, S—environment)
A	Irrelevant	Z	No fatalities or injuries. No one or a small number of people were transported for a short period of time (up to 2 hours). No one or a small number of people requiring medical attention.
		M	No or little damage. No or little impact on the local community and financial loss.
		S	Effect not measurable in the environment
B	Small	Z	Low number of injuries, no fatalities. First aid and financial and material assistance required. Need to trans-port people for less than 24 hours.
		M	There is some damage and obstruction for a maximum of 24 hours. No additional measures are required.
		S	Minor and short-term environmental impact
C	Medium	Z	No fatalities, medical assistance needed, some people require hospitalization. Additional hospital places and additional medical staff needed. Evacuated people are staying in designated areas and may return to their place of residence within 24 hours.
		M	Establish procedures to repair damaged sites, The community functions normally but with some inconvenience. Significant financial losses.
		S	Minor short-term effects in the environment or minor but long-lasting.
D	Large	Z	Need to hospitalize people with multiple injuries, large numbers of people displaced for longer than 24 hours, casualties. Specific human, material and equipment resources needed to assist people and in cleaning up the damage.
		M	Community partially non-functional, some services unreachable, need for outside help, large financial losses
		S	Long-lasting effects in the environment.
E	Catastrophic	Z	Large number of people seriously injured and hospitalized. Complete and prolonged population displacement, large number of fatalities. Assistance required for large numbers of people.
		M	Extensive damage. The functioning of the community is impossible without external assistance.
		S	Very high environmental impact, possible permanent damage.

Once the probability and effect factors have been identified, the next step is to show the interdependencies, i.e., to indicate the value of the risk, which is determined by the risk matrix (Table 3).

Table 3. Risk matrix for the National Security Threats Report [36].

PROBABILITY						
	5					
	4					
	3					
	2					
	1					
		A	B	C	D	E
		IMPACT				

Relevant risk values are color coded: blue—minimal; green—small; yellow—medium; red—large; brown—extreme. Risk acceptance is the last step in the risk assessment process, but in relation to how acceptable the designated solutions and specified forces and measures are, and whether the situation requires additional safety measures, a

distinction is made: A—acceptable risk; T—tolerable risk; WT—conditionally tolerable risk; N—unacceptable risk. Once each of the risk acceptance categories has been used, it is the responsibility of the developer to adequately justify its use, as this forms part of the sub-report.

2.2. Analysed Entity

The Branice commune is located in the south of the Opole Province. It is the only rural municipality in the Głubczyce District. The seat of the commune—the village of Branice—is located approximately 94 kilometers from the seat of the voivodeship. From the poviat town as the seat of local and special authorities: Police, State Fire Service, Sanepid, Veterinary Service, Building Supervision, which is Głubczyce by about 24 kilometers. Of the larger Polish cities, the commune's residents have Racibórz, Kędzierzyn-Koźle and Prudnik at a distance of around 40 to 60 kilometres. However, the inhabitants are closer to the Czech urban agglomeration. At a distance of 8 kilometers from Branice is the town of Krnov, 24 kilometers to Opava and 66 kilometers to Ostrava.

2.3. FMEA Method

On the basis of the risk matrices created and the analysis of the effects and causes of the hazards occurring, the FMEA method will be used to assess the risks occurring in Branice Municipality. This method is used for: analysis of causes and effects of defects; analysis of possible causes and effects of defects; analysis of causes, effects and criticality of defects. The quality management method is used by institutions concerned with preventing and removing the effects of defects occurring during construction and manufacturing processes [37]. The practical application of the method is the realization of the quality assumption of 'zero defects' and the need for 'continuous improvement' [37].

The objectives for which the FMEA method is used are to eliminate product defects permanently by recognizing the actual creative factors and to prevent the occurrence of unknown defects and those recognized in products and processes by applying the knowledge gained from experience. There is a system and problem-based method of analyzing quality management. In this article, the problem-based scope of conducting an FMEA analysis will be used, which is based on experience, current problems, analysis of deficiencies, demands made by local people and current problems occurring during pro-active activities. Next, a list of non-excludable defects and errors will be identified in relation to the already identified effect elements and the cause of the risk. The next step is to create an inventory of possible faults and errors and to demonstrate the causes of these faults and errors. Verifying the probable defects and errors correctly characterizes the risk of errors.

The parameters and guidance for adopting the criteria underlying the calculation of the Priority Risk Number (RPN) are defined on a scale of 1–5:

- probability of error based on its frequency of occurrence—the R-number (Table 4).

Table 4. Probability of error scale [38].

Score	Criteria
1	Improbable damage
2	Very little damage
3	Significant amount of damage
4	Very high level of damage
5	Inevitable damage

- the significance of the error for residents as potentially vulnerable people—the Z-number (Table 5);

Table 5. Scale of significance of the error for the resident of the area at risk [38].

Score	Criteria
1	Resident does not perceive a threat
2	Resident feels a slight risk of danger
3	Resident feels the risk of danger
4	Resident feels strongly about the risk of danger
5	The threat is real to the life and health of the resident

- probability of detection of the defect by the person in charge of the rescue operation or bystanders—Number W (Table 6).

Table 6. Probability scale for the detection of a defect [38].

Score	Criteria
1	The threat will certainly be detected
2	Very good chance of avoiding danger
3	The threat can be detected
4	Very little chance of avoiding the threat
5	The threat is inevitable

Once the ratings have been given to the above criteria, they should be substituted into the formula that determines the risk priority number [38]:

$$RPN = R \times Z \times W \quad (1)$$

where [39]:

RPN—number of risk priority;

R—incidence

W—detectability

Z—importance of

The risk level index on a scale of 1–10 varies from 1 to 1000. The final stage is to propose the implementation of preventive and corrective actions to reduce or eliminate the risk of defects identified as critical, and then to apply and test their effectiveness.

3. Results

On the basis of the Branice Municipality Crisis Management Plan and also taking into account the situation of the geographical location of Branice Municipality, its terrain, water supply system, population, as well as other factors, the following threats, their probability and consequences are possible:

- Flooding and waterlogging (Table 7)

The biggest flood risk is posed by the River Opava flowing through the villages of Bliszczyce, Boboluszki, Branice Zamek, Dzierżkowice and Wiechowice. The river Troja, which flows through the villages of Wlodzienin, Wojnowice, Nowa Cerekiew, Kozlowki and the town of Kietrz, poses no less of a flood risk. The river will be much less of a threat when the disused storage reservoir in Włodzienin comes into operation. Localized flooding during heavy rain is also possible. Such situations mainly occur in the villages of: Włodzienin, Jędrychowice and Posucice. These villages are located in a valley where, during heavy rainfall, water pushing in from agricultural fields is unable to enter drainage ditches, resulting in flooding of houses, properties and property.

Table 7. Flood and flooding risk matrix.

PROBABILITY						
	5		**X**			
	4					
	3					
	2					
	1					
		A	B	C	D	E
		IMPACT				

The main effects of flooding and localized flooding are: destroyed and damaged roads; destroyed and damaged river banks and overstretched dike structures; destroyed and damaged buildings and business premises; flooded farmland.

- Fires (Table 8)

The section of forest between the villages of Bliszczyce and Lewice is exposed to the greatest risk of fire, but it would not directly threaten the inhabitants of the neighboring villages. Most of the buildings in the municipality are made of non-combustible materials. These include single-family buildings with preserved clearances, as well as multi-family blocks and factory premises.

Table 8. Fire risk matrix.

PROBABILITY						
	5					
	4					
	3			X		
	2					
	1					
		A	B	C	D	E
		IMPACT				

The effects of fire hazards are: danger to human and animal life and health; air contamination forcing people to evacuate; destruction of property of significant value; high incidence of panic and fear; disruption of some institutions; difficulty in evacuating people; temporary disruption of communications.

- Hurricanes and strong winds (Table 9)

The entire commune is under the threat of hurricane-force winds and tornadoes combined with heavy rainfall, causing localised flooding. These anomalies pose a major threat to human life and health, as well as to the property of the borough's residents. During their occurrence, there is a possibility that roads may have to be closed or that traffic on them may have to be stopped temporarily.

Table 9. Hurricane risk matrix.

PROBABILITY						
	5					
	4					
	3				X	
	2					
	1					
		A	B	C	D	E
		IMPACT				

The effects of hurricanes and tornadoes include: fallen trees; blocked roadways through windblown debris; downed power lines, disruptions to electricity, water and telecommunications services; casualties from being crushed by fallen trees; structural damage to buildings; loss of forest stands; evacuation of residents from wind-damaged buildings; damage to internet connection lines.

- Frost and snowfall. (Table 10)

Waves of frost and freezing weather can sweep across the municipality and cause breakdowns in water supply, sewerage, electricity and telecommunications lines, paralyzing the social life of villages. During any of these failures, there is a risk of fires being started in residential buildings for space heating, as well as the preparation of hot meals and reduced hygiene standards.

Table 10. Frost and snow risk matrix.

PROBABILITY						
	5					
	4					
	3		X			
	2					
	1					
		A	B	C	D	E
		IMPACT				

A highly likely threat during the winter period for motorists and villagers throughout the borough could be the phenomenon of glaze and heavy snowfall. These can lead to: road accidents, road paralysis, disruptions to the supply of goods and the movement of residents and impediments to the access of emergency forces. The main measure to prevent and limit damage from severe frost and heavy snowfall is to inform the public of the possible danger and inconvenience of the meteorological situation.

- Drought and heat (Table 11)

Looking at the geographical location of the municipality, the threat of drought is unlikely, however, real and can occur over the total area of the municipality just like heat. Heat is a meteorological term describing a weather condition in which the ground air temperature exceeds + 30 °C.

Table 11. Drought and heat risk matrix.

PROBABILITY						
	5					
	4					
	3		X			
	2					
	1					
		A	B	C	D	E
		IMPACT				

The dangers posed by drought and heat are: drying of the soil; lowering of the groundwater level and consequent reduction of drinking water supplies; partial or total destruction of plant crops; destruction of road surfaces; loss of life and health.

- Chemical and ecological contamination (Table 12)

There is no accumulation of chemical substances that pose a threat to the population and the environment in the municipality. However, it is possible that such hazards may occur in the form of road tanker accidents along the entire route of transport of hazardous materials. A high level of threat to the environment is posed by the so-called "wild transport", carried out by motor vehicles not adapted to this type of transport by drivers without appropriate authorisations. A high environmental risk is also posed by waste not properly stored in places intended for this purpose or waste intentionally abandoned by people in forest areas, roadside ditches and wild dumps. Poisoning of soils and groundwater is generally found at such sites.

Table 12. Risk matrix for the risk of chemical and ecological contamination.

PROBABILITY						
	5					
	4					
	3					
	2					
	1				X	
		A	B	C	D	E
		IMPACT				

The hazards posed by chemical-environmental contamination are: restriction for a certain period of time of the movement of people; temporary difficulties in the supply of drinking water; hospitalization of people affected by the contamination; contamination of the environment; temporary restriction in the functioning of certain public institutions; difficulties in carrying out rescue and fire-fighting operations in the contaminated areas.

- Threats posed by radiation incidents (Table 13)

Radiation hazards for the area of Branice commune as well as for the whole country are posed by nuclear power plants in countries bordering the territory of Poland as well as those located hundreds of kilometers away in Europe. The probability of a radiological emergency is low because once such an event occurs it is difficult to determine spatially.

Table 13. Radiation risk matrix.

PROBABILITY						
	5					
	4					
	3					
	2					
	1				X	
		A	B	C	D	E
		IMPACT				

The consequences and scale of the threat posed by nuclear reactor accidents are mainly radiation sickness, contamination of soil, water and air.

- Epidemic risks (Table 14)

An epidemic situation can occur throughout the municipality and the country. The greatest risk of spreading the disease is in large concentrations of people such as schools, kindergartens, shops and other public places, where people can become infected by the droplet route. Water as a general sanitary measure can also carry a high epidemic risk. Its utility status is supervised by the State Sanitary Inspection Service and forms the basis for analyzing potential risks. So far, the epidemiological situation in the municipality as well as in the country could be considered stable. In March

2020, the first cases of infection with the SARS-CoV-2 coronavirus, or so-called COVID-19, were reported in Poland as well as in the municipality, which created a Pandemic situation worldwide. To this day, the COVID-19 coronavirus does not allow people all over the world to function normally, spreading uninterruptedly. It is also possible that smaller-scale infections among humans as well as animals may occur in the municipality due to the presence of microorganisms and bacteria in the atmospheric air.

Table 14. Epidemic risk map.

PROBABILITY						
	5					
	4					
	3					
	2				X	
	1					
		A	B	C	D	E
		IMPACT				

Threats that an epidemic may cause: hospitalization of large numbers of people requiring specialized treatment; closure of workplaces through a temporary shortage of workers; problems in the supply of electricity, water, food; the need to make property and land available for rescue operations; the need to introduce epidemic standards such as disinfectants, protective masks, protective gloves and the like; increased mortality; restrictions on the operation and functioning of certain public institutions;

- Threats to fuel security and disruptions to the supply of electricity, heat and water and gas (Table 15).

Any of the above-mentioned risks may occur on individual transmission lines and at consumption sites. These events may have the characteristics of a natural disaster and require the involvement of the forces and resources of the State Fire Service as well as those of the voluntary fire brigades in the municipality and specialist services such as the gas, electricity and water emergency services. Disruptions to the electricity supply caused by grid failures through strong winds, frost and telecommunications accidents are only possible for a short and limited period. Disruptions and delays related to fuel supply are only possible during oil crises, refinery breakdowns, road accidents, difficult traffic situations related to heavy snowfall or flooding. Major disruptions to water supply are possible during water mains failures, power outages, and the detection of the danger of chemical or biological contamination of water bodies.

Table 15. Risk matrix for fuel security risks and disruptions to electricity, heat, water and gas supply.

PROBABILITY						
	5					
	4					
	3					
	2			X		
	1					
		A	B	C	D	E
		IMPACT				

Disruptions to water and electricity supply can also result in: disruption to the sewerage network; the possibility of chemical and biological contamination posing a threat to the environment; material damage to technical infrastructure.

- Transport and construction disasters (Table 16)

In the area of the municipality, only single buildings posing a risk of collapse suitable only for demolition may occur. Buildings with multi-surface roofs of flat construction also pose a construction risk, especially during intensive snowfalls, as well as during strong winds and torrential downpours buildings built on floodplains and far from rural buildings. Single-family houses and blocks of flats equipped with an underground gas supply or residents using gas cylinders for cooking or heating in their homes also pose a high risk of a building disaster. A traffic accident is possible on the most frequented roads forming a freight transport route between Poland and the Czech Republic. These are voivodeship road 419 and district road No. 12010. The greatest risk of traffic accidents is posed by:

- the intersection of voivodeship road 419 with district road no. 12010. The reason for very frequent road accidents here is poor visibility, a piece of straight road, due to which drivers do not pay attention to the signposting in this place and during heavy rainfall the flooding of the road surface by inadequate drainage ditches, which in the absence of proper signposting creates a danger of an accident;
- intersection of the district road No. 12480 with road No. 12200. The reason for frequent accidents here is inadequate visibility caused by very tight housing and drivers not adjusting their speed in built-up areas;

- a municipal section of provincial road No. 419, district road Nos. 12010 and 12480, on the sides of which there are many poplars, which are no longer the youngest and pose a hazard due to breaking branches and falling down on drivers and pedestrians, not only during strong winds.

Table 16. Traffic and construction disaster risk matrix.

PROBABILITY						
	5					
	4					
	3					
	2				X	
	1					
		A	B	C	D	E
		IMPACT				

The consequences of building and traffic disasters are: high material damage and destruction of property; danger to the safety of human life and health; possibility of contamination of the ground surface, groundwater and also the air; disruption of road traffic; occurrence of fires; technical failures.

- Animal disease risk (Table 17)

In the municipality, due to the lack of pig farming, the most likely occurrence of animal disease is among both wild and farmed birds.

Table 17. Animal disease risk matrix.

PROBABILITY						
	5					
	4					
	3					
	2					
	1			X		
		A	B	C	D	E
		IMPACT				

The risks and consequences of animal disease are: an increase in mortality among animals; forcing farmers to dispose of infected stock, thereby incurring huge financial losses; time-consuming restoration of previous animal husbandry; disposal and disposal of excreta from dead and diseased animals; arranging appropriate conditions for isolating animals; and the possibility of disease transmission to humans.

- Plant disease risk (Table 18).

Plant disease, depending on the weather during the growing season, harvested and stored crops and the use of chemical plant protection may occur throughout the agricultural area of the Branice Commune.

Table 18. Plant disease risk matrix.

PROBABILITY						
	5					
	4					
	3					
	2					
	1		X			
		A	B	C	D	E
		IMPACT				

The effects and main risks that can occur during an outbreak of plant disease are: a reduction in the volume of agricultural crops; a threat to the life and health of people and livestock; an increase in the market price of cereals, fruit and vegetables; an increase in the price of food; an increase in food imports.

- Terrorist threats (Table 19).

The greatest terrorist threat is posed to public administration facilities and places, banks, special events and public meeting places. In the area of Branice Commune such threats include: Branice Commune Office; Co-operative Bank Namysłów with a branch in Branice; Post Office in Branice; Sports Stadium in Branice; Rural Houses of Culture and Village Common Rooms; Road infrastructure facilities such as bridges which are border crossings with the Czech state; Drinking water intakes and water supply network; Buildings of Voluntary Fire Brigades; Squares where local festivities such as harvest festivals are organized.

Table 19. Terrorist risk map.

PROBABILITY						
	5					
	4					
	3					
	2					
	1				X	
		A	B	C	D	E
		IMPACT				

The effects of terrorism are: environmental contamination; natural disasters; technical failures; disruption of public order and security; hostage-taking; abduction; causing epidemics; fires.

- ICT network failure (Table 20).

The most vulnerable to failure in the municipality is the fixed and mobile telecommunications network, and the fiber optic communications network. Technical failures, weather-related failures, terrorism and cyber-terrorism, disasters caused by land, inland waterway and air traffic can have an impact on the disruption of their smooth operation.

Table 20. ICT network failure risk matrix.

PROBABILITY						
	5					
	4					
	3					
	2					
	1		X			
		A	B	C	D	E
		IMPACT				

The consequences of the failure of the ICT network for the local population and public administration authorities will be: lack of telephone and Internet communication resulting in a lack of information about the actual state of affairs; inability to summon help in a situation of threat to human life, health and property; limited or even no services provided by authorities and points such as: banks, ATMs, shops with an electronic database of their assortment and post offices; limitation of the functioning of public administration.

- Strikes, riots and demonstrations (Table 21).

Any kind of social protests, demonstrations and riots that may take the form of general strikes may significantly affect the functioning of public administration bodies and relevant branches of the economy. Factors influencing this type of behavior include: an increase in unemployment; uncontrolled increases in the price of foodstuffs; the closure of workplaces; failure to pay employees on time; group dismissals from workplaces; football matches of local clubs and other types of sporting events. All of the above-mentioned factors do not pose a threat to the entire area of Branice Municipality. At most, they can only be local manifestations in front of workplaces or public administration bodies.

Table 21. Risk matrix for strikes riots and demonstrations.

PROBABILITY						
	5					
	4					
	3					
	2					
	1		X			
		A	B	C	D	E
		IMPACT				

Their consequences may include: danger to the life and health of residents and participants of sports competitions; disruption of public order; paralysis of regional workplaces; devastation and destruction of public and private property; considerable material losses; communication and administrative paralysis. In the municipality, there is mainly the risk of riots caused by club football matches, as well as demonstrations caused by the closure of workplaces, mass redundancies of workers and the non-payment of monetary wages.

From the analyze (Tables 22 and 23), it can be seen that catastrophic, high and insignificant risks in their effects will not occur in the area of Branice Municipality. Threats with low risk are: plant diseases, failure of ICT networks, strikes, riots, de-ministrations, animal diseases.

Threats of medium risk are: fires, fuel, energy, heat, water and gas safety, floods and flooding, hurricanes and strong winds, epidemics, transport and construction disasters, biological and ecological contamination, radiation incidents and terrorist attacks.

On the basis of these risk matrices, a risk acceptance analysis of the possible risks was developed. This is important because it can be used to determine whether the risk of a given damage is within an acceptable level. An appropriate cause and effect scale needs to be adopted for proper assessment [38].

Table 22. Values calculated risk acceptability.

PROBABILITY						
	5	5	10	15	20	25
	4	4	8	12	16	20
	3	3	6	9	12	15
	2	2	4	6	8	10
	1	1	2	3	4	5
		1	2	3	4	5
		IMPACT				

Risk acceptance thresholds have been adopted as follows [40]:

- acceptable (A – (0–4.99))—The current behavior of the authorities in monitoring threats and counteracting the negative effects of their actions is at a good level and does not require changes.
- tolerated (T – (5–9.99))—An analysis should be made as to whether introducing minor changes to the organization will improve the sense of security.
- conditionally tolerated (WT – (10–19.99))—Current solutions for protection against threats are at a weak level, they should be improved to improve safety.
- unacceptable (N – (20–25))—Immediate action is required to improve security, existing solutions should be greatly improved or replaced with new, better ones. The following matrix shows all levels of risk acceptance for individual hazards.

Risks with an acceptable level of (A) include: plant diseases, ICT network failure, animal diseases, biological contamination—ecological, radiation events and terrorist attacks. Hazards of tolerated risk (T) are: snow frosts and snowfall, drought and heat, fires, fuel, energy, heat, water and gas safety, epidemics, and communication and construction disasters. Conditionally tolerated risk (WT) includes flooding, floods, hurricanes, and strong winds.

Table 23. Values calculated risk acceptability.

5	**T**	**WT**—FLOODS AND FLOODING	**WT**	**N**	**N**
4	**A**	**T**	**WT**	**WT**	**N**
3	**A**	**T**—FROST AND SNOWFALL, DROUGHT AND HEAT.	**T**—FIRE.	**WT**—HURAGANY I SILNE WIATRY	**WT**
2	**A**	**A**	**T**—FUEL, ENERGY, HEAT, WATER AND GAS SAFETY.	**T**—EPIDEMIC, COMMUNICATION AND CONSTRUCTION CATASTROPHES	**WT**
1	**A**	**A**—PLANT DISEASES, FAILURE OF TELE-INFORMATION NETWORKS, PLANTS AND DEMONSTRATIONS.	**A**—ANIMAL DISEASE	**A**—BIOLOGICAL AND ECOLOGICAL CONVINATION, RADIATION EVENTS, TERRORISM	**T**
	A	**B**	**C**	**D**	**E**

Based on the above results of the risk analysis, it can be concluded that the area of the Branice Commune is quite safe in terms of the likelihood of threats and the scale of their effects. However, during the occurrence of these theoretically fairly safe effects of crisis events, it is also possible to occur unforeseen effects, and therefore it is important to know these best-known methods of responding during crisis management [41]:

- transfer—transfer of responsibility for the threat "to the other party";
- reduction—by improving existing solutions or creating new opportunities to reduce the level of risk to an acceptable value;
- acceptance—acceptance of the current level of risk;
- risk avoidance—inaction to reduce the effects of risk.

Two options are often used in crisis management: risk reduction and acceptance.

Risk Assessment in Crisis Management in the Municipality of Branice

Based on the risk matrices created above, it can be seen that the greatest risk of probability of occurrence and the greatest possible effects are caused by floods and flooding in the Branice Commune as well as hurricanes and strong winds. They will be subjected to FMEA analysis to diagnose which of the factors of a given threat pose the greatest

danger by calculating the RPN indicator (Tables 24 and 25). Based on the developed scale of parameters for calculating the RPN indicator, it was assumed that its value equal to or greater than the number 50 indicates the need for improvements to avoid the threat or reduce the effects of its occurrence.

The threat of flooding and flooding is quite severe for the inhabitants of the Branice Commune, and their effects carry huge financial and material losses, as well as create a high danger for the natural environment and field animals. The following analysis of causes and effects presents potential types of hazards that, based on the parameters tested, represent the height of the RPN indicator. The table shows that the highest RPN indicator is for the hazard "water intake in the riverbed". This means applying the proposed improvements such as:

- cleaning the riverbed;
- renovation of flood embankments;
- securing roads and communication bridges against possible damage;
- securing drinking water tanks against pollution;
- securing sewage treatment plants against possible leakage of feces into flood waters.

Another threat beyond safe levels is "impediment to field drainage". The proposed improvements to be applied are:

- regular mowing and cleaning of ditches;
- checking the patency of ditches;
- controlling the patency of culverts under entering arable fields.

The rest of the potential types of threat do not go beyond the safe level of the RPN indicator, which means that corrective or streamlining measures are unnecessary or can be postponed. However, remember to constantly monitor individual elements of the threat and not drag too long during any repairs, as possible effects of the threat may increase and cause greater danger.

Next, an FMEA analysis was carried out for the risks of hurricane and strong winds. This is a special type of non-safety hazard because, unlike flood or fire, it is invisible at first glance. It carries a high risk of danger to the life and health of the population, as well as to animals and the natural stand of trees.

The FMEA analysis below shows that the RPN exceeds the safe zone in two types of potential hazard. These are: "broken roofs of residential and farm buildings" and fallen trees in villages close to buildings. Suggested improvements are: inspections and pruning of dangerous tree branches and possible felling of trees threatening to fall; inspection of roof structures by building supervision.

The point "fallen trees in the riverbed" is also close to exceeding the safe level. It poses a real danger of flooding or damage to the structure of a communication bridge, posing a danger of collapse. A suggestion to avoid this type of situation is: cleaning the banks and riverbed; controlling the tree stand next to the rivers.

The remaining potential defects have an acceptable RPN which means that carrying out corrective or improvement measures is not necessary or can be postponed. However, it is important not to forget control and maintenance measures such as annual pruning of tree branches especially those growing close to high voltage lines and along traffic routes, as they create the greatest danger to human life and health.

Table 24. FMEA flood risk analysis and flooding.

Threat	Potential Type Of Threat	Potential Effect of the Threat	Importance for a Resident (Z)	Potential Causes of Danger	Risk of Occurrence (R)	Preventive Measures	Hazard Detection (W)	RPN
Flood and flooding	Water intake in the riverbed	Flooding of areas such as arable land or grassland, damage to flood embankments, damage to roads and communication bridges, damage to residential and utility buildings, feces from sewage treatment plants, contamination of drinking water tanks.	5	Heavy and long-lasting rainfall, no adjustable riverbed cleaning.	4	Cleaning the riverbed, renovation of flood embankments, securing roads and communication bridges against possible damage, securing drinking water tanks against pollution, securing sewage treatment plants against possible leakage of feces into flood waters, and construction of a retention tank.	4	**80**
	Water overflow in roadside ditches.	Flooding of communication route.	3	Neglect on the part of the road manager.	2	Regular mowing and cleaning of ditches, checking the patency of ditches and culverts under the entrances to arable fields.	3	18
	Inexpensive field drainage.	Flooded arable land, properties, residential and outbuildings, flooded and destroyed communication routes.	4	Negligence on the part of commune employees and plowing of ditches and destruction of water culverts by farmers.	4	Regular mowing and cleaning of ditches, checking the patency of ditches and culverts under the entrances to arable fields.	4	**64**
	Obstruction of roadside ditches in villages.	Flooded properties, residential and outbuildings.	3	Negligence on the part of municipal employees.	3	Regular cleaning, checking the patency of ditches and culverts under the entry into the property.	2	18
	Storm sewer obstruction.	Flooded properties, residential and outbuildings.	3	Neglect on the part of the road manager.	3	Periodic checks of storm channel patency.	3	27

Table 25. FMEA analysis of hurricanes and strong winds.

Threat	Potential Type of Threat	Potential Effect of the Threat	Importance for a Resident (Z)	Potential Causes of Danger	Risk of Occurrence (R)	Preventive Measures	Hazard Detection (W)	RPN
Hurricanes and strong winds	Break up high-voltage lines.	Lack of electricity in the villages breaks in water supply, risk of electric shock or fire.	4	Hurricanes and strong winds, fallen trees, lack of control, and felling of trees threatening to knock down their branches.	3	Control and pruning of dangerous branches of trees and possible felling of trees threatening to be felled.	2	24
	Breaking the telecommunications line.	Lack of contact and call for help, misinformation of the population.	2	Hurricanes and strong winds, fallen trees, lack of control, and felling of trees threatening to knock down their branches.	3	Control and pruning of dangerous branches of trees and possible felling of trees threatening to be felled.	2	12
	Broken roofs of residential and farm buildings.	Danger to the life and health of residents and farm animals, evacuation of residents and farm animals.	5	Hurricane and strong winds, roofing improperly.	4	Checking roof structures before building supervision.	3	**60**
	Fallen trees on road transport routes.	Inability to travel residents, cleaning and emergency services, life and health risk.	4	Hurricane and strong winds, lack of control, and felling of trees threatening to knock them down.	3	Control and pruning of dangerous branches of trees and possible felling of trees threatening to knock down.	3	36
	Fallen trees in the villages near buildings.	Damage to the construction of residential and farm buildings through the resulting windbreaks and fallen trees threaten the life and health of residents and farm animals.	5	Hurricane and strong winds, lack of control, and felling of trees threatening to knock down their branches.	5	Control and pruning of dangerous branches of trees and possible felling of trees threatening to knock down.	2	**50**
	Internet connection line corruption.	Lack of contact, disinformation of the population.	3	Hurricane and strong winds, fallen trees and branches.	3	Control and pruning of dangerous branches of trees and possible felling of trees threatening to knock down.	3	27
	Fallen trees in the riverbed.	Creation of a dam resulting in water build-up, and damage to the construction of the communication bridge.	3	Strong winds, no regular river cleaning.	4	Cleaning the banks and riverbeds, controlling the condition of trees by the river.	4	**48**

4. Discussion

Improvements consist of making the necessary changes or adaptations to specific needs arising from the malfunctioning of an area to ensure human safety. They may consist of adapting the place of danger in order to eliminate the danger altogether or to reduce the scale of its effects, as well as adequate equipment and material security to respond to and prevent a crisis that is forming. It is the responsibility of the authority in charge of the area where the need for change is reported to make all possible improvements to protect human life and health, as well as the environment and property. The authority is obliged to make reasonable improvements to its own extent if its own organizational and financial capacities allow it or if the costs of making any improvements can be sufficiently reimbursed from public funds.

The above-mentioned research methods show how important proper crisis management is during the occurrence of a crisis situation, as well as the importance of periodic inspections and clean-up or modernization work to prevent the formation of crisis situations. The research carried out indicates that the municipal area as well as the authorities are well prepared for possible emergencies. However, attention should be paid to the introduction of corrective or improvement measures as soon as possible in order to prevent the effects of the crisis situations presented in the survey method. Based on this, it can be seen that possible improvements or corrective actions would have to be introduced as soon as possible in the event of flood risks and hurricanes and strong winds.

During the occurrence of heavy and prolonged rainfall, the greatest danger to the population living along the mountain Opava River and the Troja River is posed by rising water in the riverbed. The local population remembers the catastrophic effects of the flood of the century in 1997 and fears the occurrence of such a situation again. The main measures to prevent flooding are: cleaning of the riverbed; repairing the dykes; securing roads and communication bridges against possible damage; securing drinking water reservoirs against pollution; securing sewage treatment plants against the possible leakage of faucal matter into the flood waters; building a reservoir.

The task of repairing the dykes on the River Opava has been under way since 2019. At the moment, the modernization work is nearing completion, resulting in an increased level of safety for the inhabitants of the village of Bliszczyce, which suffered the most during the 1997 flood. Another task that has already been partially completed is the construction of a reservoir on the River Troja. This is partly because the reservoir was constructed and put into use, but after some time it became apparent that there were constructional flaws in its design which caused it to leak and allow water stored in it to enter the cellars of the houses of residents of the surrounding village of Wlodzienin. However, despite the design flaws, the reservoir fulfils its safety role during heavy and prolonged rainfall, protecting nearby villages from flooding. However, there are no terrain possibilities to build such a reservoir on the River Opava.

The protection of drinking water reservoirs has also been implemented through a structural elevation of the water intake point, which prevents flood and rainwater from entering the reservoir and creating a risk of contamination. The fecal matter tanks at the wastewater treatment plant were protected in a similar way. In addition, appropriate drainage has been carried out there to prevent contamination of the river water. Tasks that should be carried out systematically are the cleaning of riverbeds. These measures will significantly prevent the formation of dams creating water spills that threaten the safety of the population, as well as creating a risk of structural damage to communication bridges and residential and farm buildings.

The second potential hazard beyond the safety indicator of the FMEA method is the obstruction of field drainage which results in: flooded arable land, flooded properties, residential and farm buildings, flooded and damaged communication roads.

Suggestions for improvements to avoid this danger are: regular mowing and cleaning of ditches; checking the state of patency of ditches and culverts under field entrances. These tasks should be carried out systematically and thoroughly, as this danger occurs very often in the area of Branice Commune causing high financial and mate-rial losses for the inhabitants as well as the communal budget.

The greatest potential hazards during hurricane and strong winds are torn-off roofs of residential and farm buildings and fallen trees in villages close to buildings. These pose the greatest threat to human life and health by damaging the structures of dwellings and outbuildings and creating windbreaks and fallen trees. Suggestions for improvements to prevent this type of incident include: inspection of the roofs of buildings; inspection and felling and care of trees that pose an immediate threat to human life and health.

The above suggested improvements are constantly applied in the municipal area and successively implemented, which translates into no recorded incidents of this type in the last five years. However, a real threat close to exceeding the safety point and combining the phenomenon of flooding with hurricanes and strong winds are fallen trees in the

riverbed resulting in the formation of dams and possible damage to traffic bridge structures. A proposed improvement to prevent the formation of this type of hazard is the cleaning of banks and riverbeds and the control of tree stands along the riverbed. The implementation of these improvements should ensure sufficient protection of the lives and health of residents, which are the most important factors during emergency management operations.

5. Conclusions

A sense of security of one's own and one's most cherished values such as life, health, family and home is of paramount importance in human life. Various types of disasters, cataclysms or emergency situations always lead to a loss of this sense of security and have enormous negative effects on people, animals and the environment. Any kind of protection against the effects of the risks described in the paper will always be important for people and the need to do it themselves. This is why the need to make precise emergency response plans to anticipate the potential effects and likelihood of these hazards is very important.

The risk analysis that has been developed shows what possible hazards and their consequences should be prepared for by the units responsible for hazard forecasting. Because the probability of certain hazards occurring varies quite a bit, the risk analysis carried out makes it possible to determine the effort needed for a certain type of hazard in order to minimize its effects. This difference can be seen in the occurrence of floods and localized flooding, whose effects and probability of occurrence are quite high, and the occurrence of strikes, whose probability of occurrence and magnitude of effects are very low.

Learning from these events is the first step in developing proper risk management, as well as directing rescue and clean-up services in appropriate numbers and with appropriate preventive measures. Analysis and monitoring by the people and institutions responsible significantly leads to an improvement in the state and sense of security for residents, animals and the environment. The conclusions drawn from the presented work on crisis management in the area of Branice Commune are as follows:

(1) a properly prepared crisis management plan is the most important and effective method to deal with emergencies that threaten the life and health of citizens;
(2) hazards have been, are, and will continue to accompany people, so adequate preparation is needed to minimize their effects or even eliminate them altogether.
(3) during the occurrence of an emergency, the sphere of logistical action is very broad and determines the methods and actions of the relevant services in order to reduce the effects of the threats that occur.
(4) the conducted analysis of threats possible to occur in the area of Branice Commune indicates that the highest probability of occurrence of a threat is floods and waterlogging as well as hurricanes and strong winds.
(5) the conducted FMEA analysis indicates that a very important factor preventing the creation of the threats discussed in the point above are periodical inspections and cleaning or modernization works of the given threat areas.

In summary, the FMEA analysis showed that in the analyzed municipality, the most serious risks were flooding and flooding, as well as hurricanes and high winds. The following remedial actions are proposed in the analysis and to improve these areas in the rural areas: water surge in the riverbed (cleaning of the riverbed; repair of dikes; securing roads and communication bridges against possible damage; securing drinking water reservoirs against pollution; securing sewage treatment plants against possible leakage of faucal matter into flood waters); obstruction of field drainage (regular mowing and cleaning of ditches; checking the patency of ditches; roofs of residential and commercial buildings and fallen trees in villages close to houses (inspections and pruning of dangerous tree branches and possible removal of trees threatening danger of falling; inspection of roof structures by building supervision) and fallen trees in riverbeds (cleaning of banks and riverbeds; inspection of tree stands near rivers) [42–44].

The policy implications of this study may be far-reaching, not least because it may determine rural managers to change their management and attention to and response to crisis threats that may occur in such areas.

Regarding the limitations of the study, it is important to remember that it was conducted on the author's chosen terrain. In most cases, changes in the terrain, the population or its management have a determining influence on the shaping of emergency response principles. Therefore, the study conducted should provide an overview of the research issue undertaken.

In the future, it is planned to extend the study area to equal rural areas occurring in the world, and it is also planned to verify the existing hazards on the ground on a continuous basis. In addition, it is intended to extend the deeper cooperation with both the rural authorities and the rescue units in order to imply the research results in the actual territorial units.

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The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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