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Analysis Of Emergencies And Their Causes

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Abstract: *This article analyzes the types of natural, technological, and environmental emergencies, their status in our Republic based on statistical data, and proposes measures for preventing emergencies and reducing their consequences. The suggestions are based on international experience and aim to ensure public safety by implementing prompt and effective actions.*

Keywords: Emergencies, natural disasters, technological hazards, environmental hazards, statistics, safety, geological phenomena, hydrometeorological phenomena, epidemiological phenomena, accidents, disasters, ecology, environment.

Relevance of the study: Currently, the frequent occurrence of emergency situations (ES) on a global and local scale poses a serious threat to human life, public safety and the economy of countries. The increase in natural disasters (earthquakes, floods, droughts, fires, etc.) and man-made accidents (explosions, radiation releases, road accidents), population density and urbanization further exacerbate the negative consequences of ES. In such conditions, a thorough analysis of the causes of ES and the development of specific mechanisms for their elimination have become one of the urgent tasks of today.

International organizations such as the World Health Organization (WHO), the United Nations Office for the Coordination of Humanitarian Affairs (UNOCHA), the International Federation of Red Cross and Red Crescent Societies (IFRC), and UNESCO are implementing various programs and strategies to prevent and reduce emergencies. As a result of their efforts, mechanisms for information exchange, humanitarian assistance, risk assessment and management are improving at the global level.

A number of local and foreign scientists have conducted research on the scientific study of emergency situations. In particular, in Uzbekistan, specialists such as I. Khoshimov, B. Bakhodirov and Sh. Mamatkulov have conducted research on the factors that cause emergency situations, measures to predict and reduce them. Abroad, Ye.M. Mironov (Russia), D. Alexander (Great Britain), P. Blaikie (France) and others are recognized scientists in the field of FV analysis, risk models and crisis management.

The purpose of the study: To scientifically analyze various emergency situations and their causes, identify their general and specific factors, and propose effective measures to reduce risks.

Based on the purpose of the study, the following tasks were set:

- classification and systematization of emergency situations by type;
- study of the factors leading to their occurrence;
- comparative analysis of international and local experiences;
- development of proposals aimed at increasing security in the conditions of Uzbekistan.

Research method: The research method used scientific approaches such as systematic analysis, comparative analysis and content analysis. Open data, reports and scientific sources published by international organizations and government agencies were also used as a basis.

The results of this study can serve to improve emergency prevention measures and develop effective solutions aimed at ensuring the safety of the population.Tahilil va natijalar.

One of the important tasks of ensuring national security is to prevent and effectively combat crises in the state and society, and to guarantee the sustainable development of the country. One of the main factors leading to a crisis in national security is natural disasters, man-made accidents, and ecological disasters. Situations arising under the influence of such events are often characterized as emergencies [14]

For this reason, from the first years of Uzbekistan's independence, one of the most important tasks was to protect the population and territories of the country from various emergency situations, to create a unified state system and a coordinating body for the system. By the Decree of the President of the Republic of Uzbekistan No. PF-1378 "On the Establishment of the Ministry of Emergency Situations of the Republic of Uzbekistan" dated March 4, 1996, the Ministry of Emergency Situations of the Republic of Uzbekistan was established. This ministry was established on the basis of the Civil Defense Headquarters, which operated during the former Soviet Union, and is somewhat different in terms of its tasks and functions. If the main task of the Civil Defense Headquarters was to protect the population from weapons of mass destruction, the Ministry of Emergency Situations is aimed at protecting the population and territories from natural and man-made emergencies, in accordance with our foreign and domestic policy pursued by our President and government.

To address these challenges, based on the experience of developed countries, a number of laws and by-laws have been developed in cooperation with relevant government bodies, and they are still being improved today. Examples include the Laws "On

Protection of the Population and Territories from Natural and Man-Made Emergencies" (1999), "On Civil Protection" (2000), "On Radiation Safety" (2000), "On Combating Terrorism" (2000), and several other laws and by-laws.

Based on the analysis of these regulatory and legal documents, and the emergency situations occurring in the world, including in our Republic, we can characterize them as follows.

The development stage of emergency situations can be conditionally divided into five phases [11,12]:

-awakening phase- conditions for a future emergency situation are created.

-development and escalation phase- regardless of the level of development and its scale, the human factor plays a key role.

-peak phase- processes that pose a threat to people and the environment get out of control, that is, emergency situations are observed.

-decline process- the stage of the end of the period of emergency situations, the period of the beginning of rescue and other urgent work.

According to the speed of spread of emergencies[3,5]:

-random emergencies: (earthquakes, explosions, accidents with vehicles);

-severe emergencies: (fires, explosions with the release of toxic gases);

-moderate (average) emergencies: (floods, volcanic eruptions, accidents caused by the release of radioactive substances);

-continuous emergencies: (slowly spreading hazards, droughts, the spread of epidemics, soil pollution, water pollution with chemicals, etc.).

In accordance with Resolution No. 455 of the Cabinet of Ministers of the Republic of Uzbekistan "On the Classification of Emergencies of a Technogenic, Natural and Ecological Nature", emergencies are mainly divided into 3 types and are explained as follows:

1. Natural emergencies. Natural emergencies occur due to the external and internal effects of various forces on the biosphere, as a result of natural laws, disasters, and other natural processes.

External impacts are caused by the influence of the distant universe (galaxy, solar system), near-atmosphere processes (magnetosphere, atmosphere), as well as processes occurring directly on the Earth's surface.

Internal impacts are natural phenomena that occur as a result of the impact on the biosphere over a certain period of time, associated with the stratification and physical and mechanical properties of substances, internal processes in the Earth, magnetic field inversion, magmatic and tectonic activity, the movement of lithospheric plates, volcanism, seismicity, etc. These include dangerous geological, hydrometeorological and epidemiological processes.

2.Technogenic emergencies - these types of emergencies are directly or indirectly caused by human activity and include accidents in transport, chemical, radiation and fire-explosive industrial facilities, hydraulic and utility structures, and structural failures of buildings and structures.

3. Environmental emergencies - This type of emergency includes events related to environmental pollution, such as hydrosphere, atmosphere, and soil erosion.

In addition, emergencies are divided into local, regional, republican, and transboundary emergencies, depending on the scale of their spread and economic damage.

The factors of occurrence of emergencies, their scale of distribution, and the harmful effects caused may vary. However, regardless of their nature, the mechanism for their assessment is as follows[11]:

1) naming of emergencies;
2) the nature of emergencies;
3) causes of emergencies;
4) damaging factors of emergencies;
5) factors increasing the risk of emergencies;
6) predictability of emergencies;
7) elimination of emergencies;
8) determination of material damage (direct and indirect).

Analysis of data provided by international organizations and the Ministry of Emergency Situations shows that during the period 2000-2024, the total damage caused by emergencies amounted to 5.2 trillion US dollars. During this period, more than 9,000 emergencies were recorded in the world, 7,000 major disasters occurred, 1.2 million deaths occurred, and more than 4 billion people were affected.

Table 1

Number of emergencies by type in 2000–2024

Type	Number of incidents	Deaths, thousand people	Financial loss, billion US dollars
Natural disasters	6500	1,150	2500

Technological events	2000	200	500
Epidemiological diseases	500	300	50

Table 2

Statistics of natural emergencies in Uzbekistan (2018-2023)

Year	Number of earthquakes	Number of floods	Flood	Damaged area, km²
2019	3	4	8	120
2020	4	6	10	180
2021	2	3	7	200
2022	3	5	9	160
2023	4	7	6	210
2024	5	8	7	250

Number of emergencies (2019-2024)

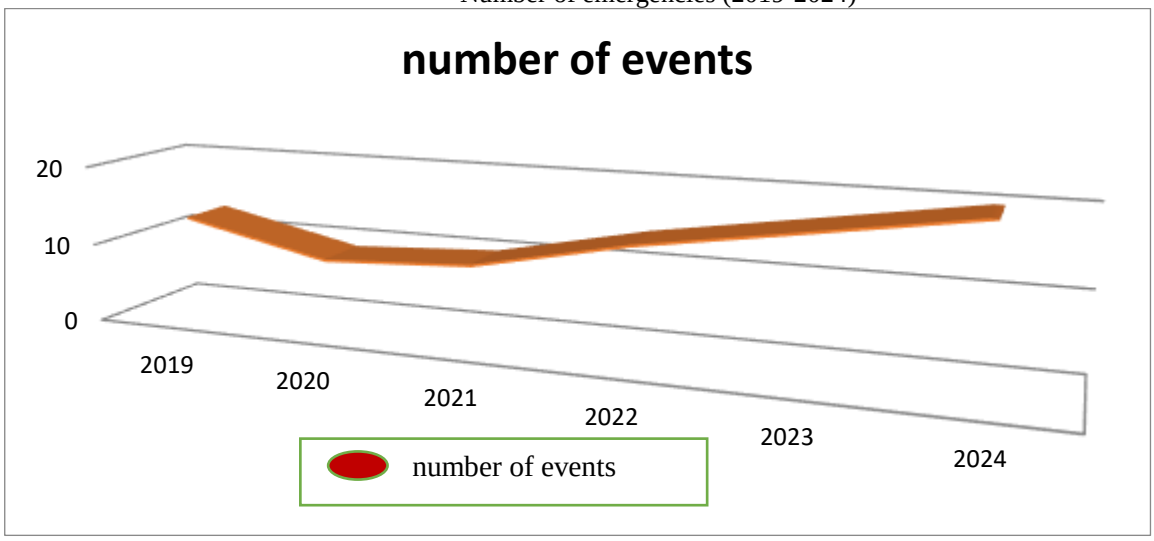

Figure 1. Diagram of emergencies by year.

The number of emergencies and their severity depend on the following factors:

$$FV = \alpha \cdot N + \beta \cdot T + \gamma \cdot S + \delta \cdot I \quad (1)$$

where, FV — indicators of emergency situations (number, amount of damage), N — natural factors (earthquakes, floods, etc.); T — technological risks (accidents, pollution); S — social factors (population density, economic situation); I — impact of climate change; α, β, γ·, δ — adjustment coefficients.

As a result of forecasting emergency situations, it is possible to take measures to prevent them, reduce their scope and damage, and eliminate their consequences by determining in advance the amount of forces and means necessary. Forecasting emergency situations includes several stages. (Figure 2) [7,8].

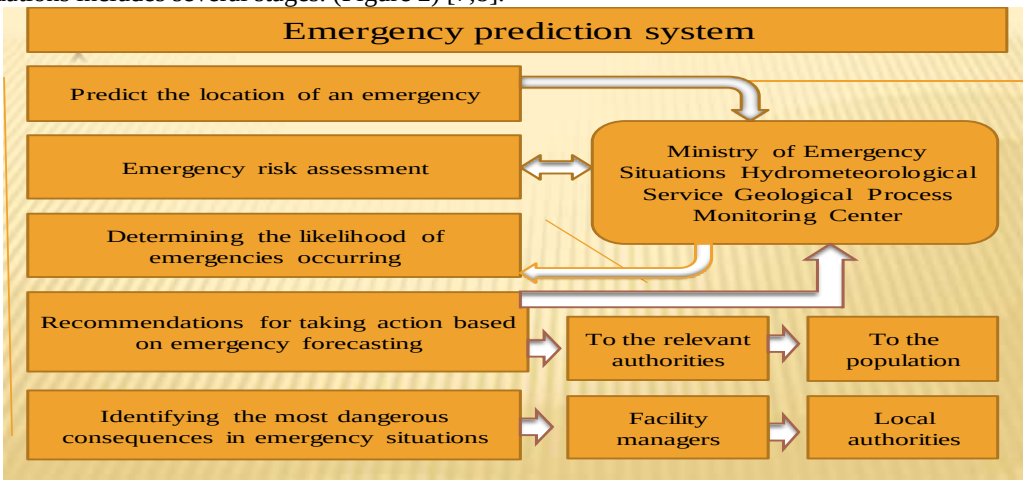

Figure 2: Algorithm for predicting the location of emergency situations

In particular, a number of systematic measures are being taken to prevent emergencies.

1. Risk assessment and analysis - identification of hazardous areas and facilities, assessment of natural and man-made sources of hazards, analysis of the possible consequences of existing hazards.

2. Creation of a regulatory framework - it is necessary to adopt laws and regulations on emergencies, develop and implement safety standards.

3. Carrying out preventive work - it is necessary to reduce or eliminate sources of hazards, comply with the rules of sustainable and safe construction, strengthen sanitary and environmental control.

4. Training of rescue services - it is necessary to form rescue services and special equipment,. train and retrain rescuers,. create a material and technical base for rescue operations. .

5. Informing and training the population - it is necessary to introduce emergency warning systems for the population, inform the population about the rules of conduct, regularly conduct evacuation drills in the letter and enterprise teams.

6. Organizing a monitoring and control system - it is necessary to constantly conduct seismic, hydrological and meteorological observations, strengthen control over hazardous facilities, and carry out technical preventive work to prevent man-made accidents.

7. Cooperation and international relations - it is necessary to exchange information with international organizations, cooperate with neighboring countries in emergency situations, use experience and technical assistance.

It follows that, based on the above analysis, we can conclude the following.

Of course, in solving the above problems, only as a result of a thorough analysis of natural disasters, industrial accidents, and emerging environmental situations characteristic of the region of Uzbekistan, can the most favorable measures be determined, which will ultimately reduce the scale of both material and moral losses in any emergency situations.

At the same time, the authors make the following recommendations for a more in-depth analysis of emergency situations and the development of measures based on the analysis:

1) expanding the system of regular monitoring to identify emergency situations in advance;
2) increasing the level of preparedness for emergency situations;
3) strengthening safety control at industrial facilities in order to reduce technogenic risks;
4) taking measures to reduce emergency situations associated with environmental hazards;
5) improving the emergency response system;
6) strengthening cooperation with international organizations;
7) developing scientific research and educational programs:

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