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NATURAL HAZARD–RELATED EMERGENCY SITUATIONS: CONCEPT, TYPES, AND THEIR CONSEQUENCES

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Abstract: This article discusses the concept of natural hazard–related emergency situations, their main types, as well as the socio-economic and environmental consequences they have on society and the natural environment. In addition, the factors contributing to the occurrence of natural emergency situations and the general directions for reducing their impact are analyzed. The article is presented on the basis of a theoretical and practical approach, with particular attention paid to issues of ensuring public safety.

Keywords: emergency situation, natural disasters, earthquake, mudflow, drought, public safety.

At present, natural hazard–related emergency situations are considered one of the factors posing a serious threat to human life and safety worldwide, including in the territory of Uzbekistan. As a result of climate change, disruption of natural balance, and the intensification of anthropogenic impacts, the likelihood of earthquakes, mudflows, floods, droughts, and other natural disasters is increasing. Such situations can cover large areas within a short period of time and cause significant damage to human life and health, material assets, and the natural environment. Natural hazard–related emergency situations manifest not only as emergency conditions but also as important factors affecting socio-economic stability. Their consequences are associated with disruptions in production processes, a decline in the living standards of the population, and the intensification of environmental problems. Therefore, the scientific study of the essence of natural emergency situations, the systematic classification of their types, and the analysis of their consequences are of urgent importance. The purpose of this article is to reveal the concept of natural hazard–related emergency situations, highlight their main types, and analyze their impact on society and the environment from a theoretical and practical perspective.

An emergency situation (ES) is a condition that has arisen in a specific territory as a result of an accident, catastrophe, dangerous natural phenomenon, natural or other disaster, which may lead or has led to human casualties, damage to human health or the natural environment, significant material losses, and disruption of human life activities. Naturally, natural, technogenic, environmental, military, and social causes play a special role in the emergence of such conditions. At the same time, the scale of the territory affected by an emergency situation and the amount of material damage caused may vary. Thus, emergency situations are multifactorial and complex processes, in the occurrence of which various causes manifest themselves in close interrelation. Depending on the nature of emergency situations, the territory they cover, and the consequences they cause, they can be classified according to various criteria. This article analyzes specifically natural hazard–related types of emergency situations, their main forms, and their impact on social life.

According to their origin, emergency situations (ES) are classified as technogenic, natural, and environmental. In order to improve the system for protecting the population and territories from natural and technogenic emergency situations, an annex was approved to Resolution No. 455, “On the Classification of Technogenic, Natural, and Environmental Emergency Situations,”

adopted by the Cabinet of Ministers on October 27, 1998.[1]

Natural Hazard–Related Emergency Situations include the following: 1. Geological hazardous events: Earthquakes that lead to human casualties, varying degrees of destruction of administrative and industrial buildings, technological equipment, energy and transport infrastructure, communication systems, social-purpose buildings, and residential houses, as well as disruption of production and human life activities; land movements, landslides, and other hazardous geological phenomena that have caused or may cause human fatalities and require the temporary relocation of people from dangerous areas or permanent resettlement to safe locations.

2. Hydrometeorological events: Floods, water accumulation, and mudflows that pose a danger to human life, submerge settlements, some industrial and agricultural facilities, infrastructure, and transport systems, disrupt production and human life activities, and necessitate urgent evacuation measures; snow avalanches, strong winds (storms), hail, and other hazardous hydrometeorological phenomena that have caused or may cause injury or death to residents, tourists, and athletes in settlements, sanatoriums, resorts, and health camps. 3. Emergency epidemiological, epizootic, and epiphytotic situations: Rare but highly dangerous infections causing diseases such as plague, cholera, and yellow fever;

Infectious diseases affecting humans, including rickettsial infections – epidemic typhus, Brill's disease, Q fever; rabies; Zoonotic infections anthrax; Viral infections – HIV/AIDS;

Epidemics – infectious diseases affecting a group of people, where the source or transmission factor is the same, with 50 or more cases in a single settlement; Groups of people affected by diseases of unknown etiology – 20 or more cases;

Malaria of unknown diagnosis – 15 or more cases; Situations with mortality or morbidity rates three times or more than the average statistical level; Poisoning with toxic substances – at least 10 affected individuals and 2 or more deaths; Mass food poisoning – at least 10 affected individuals and 2 or more deaths; Epizootics – mass disease or death among animals; Epiphytotics – mass death of plants.

Natural disasters play an important role in the occurrence of emergency situations, as hazardous geological processes and phenomena are significant factors. Therefore, their catastrophic consequences are studied to protect the population and national economic facilities; the causes of hazardous geological events, their spatial distribution patterns are analyzed, assessed, and forecasted, and various measures are developed to counter them. The implementation of this issue is outlined in Articles 21 and 22 of the Law "On Protecting the Population and Territories from Natural and Technogenic Emergency Situations," and the necessity of documents in such situations is specified in Article 3 of the same law. The responsibilities of citizens in protecting themselves from emergency situations are stated in Article 16, while the obligations of local state authorities regarding citizen protection are outlined in Article 10.

Hazardous geological processes occurring on the Earth's surface mainly result from the influence of internal forces of the Earth and external natural factors. In addition, according to scientific, technical, and specialized literature, human activities related to economic, construction,

[1] Resolution of the Cabinet of Ministers of the Republic of Uzbekistan No. 455, "On the Classification of Technogenic, Natural, and Environmental Emergency Situations," October 27, 1998.

and military operations also affect the geological environment, resulting in disasters of varying scales, both large and small. In this context, we will briefly consider some natural disasters. In particular, historical written sources indicate that hundreds of catastrophic earthquakes have occurred throughout human history.

The ancient ruins of Pompeii in Greece serve as evidence of past seismic events. Scientists have discovered numerous ancient city ruins on the ocean floor. Along the present-day shores of the Issyk-Kul region, remains of ancient structures, palaces, and castles have been preserved, bearing witness to those ancient earthquakes. Among earthquakes that occurred over the past 50 years, the scale of destruction and casualties in Chile, San Francisco, Tokyo, Ashgabat, Spitak, and Tashkent stand out. On May 27, 1995, an extremely strong earthquake with a magnitude of 9.2 struck the town of Neftegorsk in Russia. According to reports, more than 95% of the buildings in the town were destroyed, and 1,841 people perished. The strongest earthquake in Uzbekistan occurred in 1902 in Andijan, with a magnitude of 8–9. Other significant events include the Chotqol earthquake in Namangan in 1946, as well as earthquakes in Tashkent in 1866 and 1968 (7–8 magnitude, up to 1,000 casualties), Gazli (8–10 magnitude), and in Tajikistan in 1907 in Hisor, which destroyed about 15 villages and caused approximately 1,000 fatalities. To organize the protection of the population and economic facilities from earthquake-induced disasters, it is necessary to study the affected areas, the causes of earthquakes, classify their genetic types, assess the forces acting on structures, forecast seismic activity, and develop a comprehensive set of preventive measures. During an earthquake, seismic waves are generated in the Earth's crust. The origin of these waves is called the hypocenter or focus of the earthquake. Its depth ranges from 2 to 70 km, and the surface location is referred to as the epicenter. Seismic waves are divided into three types: longitudinal, transverse, and surface waves. The impact of these waves on inhabited areas and structures depends on geological, geomorphological, hydrogeological, and engineering-geological conditions of the terrain. Engineering geology deals with their study, assessment, and prediction.

Landslides are another type of natural emergency situation. Studying, assessing, forecasting, and protecting the population and economic facilities from landslides is important for the development of the national economy. A landslide is the downward movement of the upper part of loose rock masses located on mountains, slopes, or riverbanks under the influence of surface and subsurface water and their own weight. Landslides frequently occur in Crimea, the Caucasus, along the Volga, and in the mountainous regions of Central Asia. Over the past 15 years in Uzbekistan, many landslides have occurred in areas with developed mining industries, such as Xumson, Bogiston, Xo'jaken, Chibarg'ota, and other villages in the Ohangaron, Olmaliq, Oltintopkan, and Yuqori Chirchiq districts, as well as in the mountainous regions of Surkhandarya, Kashkadarya, Samarkand, and Jizzakh provinces. In April 1964, a landslide in the village of Ayniy in Tajikistan completely blocked the Zarafshan River. Thanks to timely measures taken by scientists, agricultural lands and villages were protected from flooding. A landslide occurs under specific conditions: the slope must be steep enough for rock layers to move, the rock layers must be sufficiently thick, seasonal or annual precipitation must be substantial, and permeable or impermeable layers must be stratified. Rain and snowmelt infiltrate soils and rocks such as sand, clay, and limestone on the slope, softening and weighting them. Groundwater in impermeable layers begins to move downward along the slope, reducing the natural cohesion of the rocks. As a result, the force holding the rocks on the slope sharply decreases relative to the downward force, causing the mass to slide downward.

Avalanches are the result of snow masses sliding or tumbling down steep mountain slopes. During winter, large amounts of snow accumulate on high mountains, increasing its thickness. Under its own weight, the snow becomes compacted, recrystallizes, and hangs on the slope. As

its thickness increases, its stability decreases, and under the influence of strong winds or sudden vibrations, the thick snow mass begins to move, sliding or tumbling down the slope. Avalanches can be dry or wet. If the upper layer of snow is slightly frozen and a thick layer of snow falls on top of it and starts sliding downward due to certain factors, a dry avalanche occurs. In such cases, landslides can be extremely large. In spring, as meltwater infiltrates and wets the base of the snow, the stability of the snow mass decreases, resulting in a wet avalanche. Dry avalanches can move at speeds of 100 km/h and sometimes even 300–400 km/h, while wet avalanches move more slowly at speeds of 20–50 km/h.

Natural hazard–related emergency situations have multifaceted consequences and can be grouped as follows:

Social consequences: human casualties or injuries, population migration, deterioration of living conditions.

Economic consequences: interruption of production, destruction of infrastructure, significant material damage.

Environmental consequences: soil erosion, water and air pollution, disruption of the natural balance.

In conclusion, natural hazard–related emergency situations are one of the factors posing a serious threat to the development of modern society and public safety. Earthquakes, floods, water inundations, droughts, landslides, and other natural phenomena can cause significant harm to human life and health, material assets, and the environment. This article elucidated the essence of natural hazard–related emergency situations, analyzing their main types and consequences. The analysis shows that the scale and impact of such emergencies directly depend on the region's natural and geographical characteristics, the state of infrastructure, and the population's level of preparedness. Therefore, to prevent natural emergencies, reduce their negative consequences, and ensure public safety, it is important to improve monitoring and forecasting systems, strengthen warning mechanisms, and enhance the population's preparedness for emergencies. Systematic measures carried out by state authorities in cooperation with society serve to mitigate the effects of natural hazard–related emergency situations.

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