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Estimates and Methods of Damage from Man-Caused Emergencies of Situations at Hazardous Production Facilities of the Republic of Uzbekistan

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Annotation: Risk assessment in a certain territory, including calculations of the possible number of dead (injured) people and economic losses that may be caused by hazardous phenomena, is carried out on the basis of an analysis of the danger of the territory, threats to people and objects, their vulnerability and possible damage. The article reveals the concept of damage and methods for its assessment from a hypothetical and real accident.
Keyword: Emergency situations damage assessment, threat, consequences of accidents, environment, consequences of an accident.

Introduction. The threat to human life from technogenic hazards is realized in the form of negative impacts [1, 2] resulting from accidents and disasters at technosphere objects. These events are directly related to damage.

According to the ideas established at the present time, damage is the result of a negative change in the state of objects due to some events, phenomena, actions, expressed in violation of their integrity or deterioration of other properties, i.e. damage is understood as actual or possible social and economic losses (deviation of human health from the average value: his illness or even death, disruption of the process of normal economic activity, loss of one or another type of property, other material or natural values, etc.), as well as deterioration of the human environment [3, 4].

Main part . The concept of "consequences of an accident" is of a generalized, non-economic nature, while the concept of damage is an economic quantity that must be presented in monetary terms. In other words, damage is the estimated consequences. Damage assessment consists in determining its value in physical or monetary terms (economic damage assessment).

We will distinguish between methods for assessing damage from a hypothetical and real accident. If a hypothetical accident is considered, then these types of damage are said to be assumed.

For various scenarios of the development of an emergency situation (ES), various values of damage are obtained by the calculation method. Due to the influence of a large number of random factors on the amount of damage in forecasting problems, one should consider the random value of damage W , described by the distribution function F (w)= P (W < w).

Definition of F (w) is carried out by standard methods of mathematical statistics [5-9]. Statistical data on damage in real emergencies at a certain time interval form a sample from a certain general population and are described by a statistical distribution function. Due to the insufficient amount of recorded statistical data on damage in emergencies, the form of the distribution functions F (w) has not yet been established.

When it comes to protection measures and the assessment of the effectiveness of protection costs, then all types of damage are called prevented.

Mathematically, the prevented damage is determined by the ratio:

A.W. \u003d W 0 - W 1

where W0 _ and W 1 - damage before and after the adoption of protective measures, respectively.

When considering the consequences of an accident, we will distinguish between direct, indirect, total and general damage [10]. In the first approximation (upper estimate), the damage from a natural disaster or accident is equal to the costs of restoring the situation that existed before their occurrence.

The consequences of an accident are a chain of successive interrelated events. The number of links in this chain can be quite large. Direct losses (damage) include destruction, damage, negative consequences of the impact of damaging and harmful factors on natural objects and the national economy (land, people, flora and fauna, buildings, structures, equipment, raw materials, crops, livestock, etc.).). The influence of the same consequences on the state and functioning of other objects of nature and the national economy (not directly

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affected by damaging factors) is referred to as indirect damage (losses).

So under direct damage As a result of an accident, we mean the losses and damages of all objects of interest to human life that have fallen into the zone of action of the damaging and harmful factors of a dangerous phenomenon. They consist of damage to human health, irretrievable losses of fixed assets, assessed natural resources in the sphere of human interests and losses caused by these losses, i.e. shortage of profits by enterprises, the state - various taxes and insurance payments, etc.

Indirect damage from a natural disaster or accident - these are losses, damages and additional costs that will be incurred by facilities that do not fall into the zone of negative factors of a dangerous phenomenon and are caused by violations and changes in the existing structure of economic relations, infrastructure, as well as losses (additional costs) , caused by the need to take measures to eliminate the consequences of the accident. Most often, all groups of consequences appear in the cycles of generating indirect damage. At the level of the state, regions and industries, a chain indirect risk appears, depicted as a “risk tree” with the number of cycles $m \to \infty$. It is practically expedient to take into account no more than 6-10 cycles [11], since the analysis of the sequence of interrelated events in the event of an emergency shows that as you move along their chain, firstly, the influence of the initial event weakens, and, secondly, , the difficulties of assessing indirect damage increase. Based on these considerations, an expert assessment as a share of direct damage is often used as an assessment of indirect damage without detailing and analyzing individual components.

Total damage is the sum of direct and indirect damages. The total damage is determined at a specific point in time and is intermediate compared to the total damage, which will be quantified in the long term [12]. The need to consider time-distributed or remote manifestations of damage is especially important for accidents associated with the impact on environmental components.

According to the object of influence of negative factors, the following types of damage are distinguished:

the life and health of specific people (medico- biological), which is determined by specific disorders for their health, leading to social losses for some of their generality and, as a result, a reduction in the average expected life expectancy [13];

socio-economic system (socio -economic), which consists in the loss of one or another type of property, the cost of resettlement of people, the payment of compensation to victims, lost profits from unconcluded and terminated contracts, disruption of the process of normal economic activity, deterioration of living conditions of people and etc.;

natural environment (environmental) - the deterioration of the natural environment or the cost of its restoration, the loss of the national economic value of the territories or the cost of its rehabilitation, and others.

The complexity of damage calculation requires taking into account the specifics of the tasks solved with its help. The two most frequently solved problems are:

protection measures taken;

amount of damages to be compensated.

The average damage from emergencies can be established according to statistical data [14]. For example, the average damage from one emergency of a man-made nature in 2020 amounted to 27.8 million soums . [16]. For rare events, the average damage can be estimated from the calculated data for various scenarios for the initiation and development of emergencies and subsequent averaging, taking into account the weights of the scenarios.

The assessment of the risk of damage in a certain area usually includes calculations of the possible number of people killed (injured) and economic losses that may be caused by hazardous phenomena. It is carried out on the basis of an analysis of the danger of the territory, threats to people and objects, their vulnerability and possible damage. First, data are collected and catalogs of hazardous phenomena occurring in the study area are compiled. Their most dangerous types, frequencies of manifestation, physical parameters are determined. Then maps of natural and technospheric hazards are compiled, reflecting the frequencies of the implementation of dangerous phenomena of a fixed strength. Depending on the goals and objectives, maps can have a scale from global to local. Next, the relative position of the sources of danger and objects of influence of their damaging and harmful factors is analyzed, and then the vulnerability of the environment to dangerous phenomena of various destructive forces. The vulnerability of the environment is affected by the security and stability of the elements of the technosphere (civil, industrial facilities, residential buildings, highways, etc.).

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Conclusions: Analysis [13] shows that the risk is assessed by indicators of danger, threat, vulnerability of the environment in case of accidents and possible consequences of natural disasters (catastrophes). The listed particular indicators and risk as their integral expression is a characteristic of the territory under consideration and can be reflected on a cartographic basis reflecting territories (areas) of varying degrees of risk. Maps of individual risk for the population are presented as isolines connecting points with equal values of individual risk. In conclusion, we note that with the help of risk maps it is possible to solve a number of practically important tasks of risk management and planning the socio-economic development of the region (oblast, district, city):

rational allocation of resources to reduce risks and mitigate the consequences of emergencies;

identification of territorial zones located in the area of excessive risk for the priority adoption of protection measures;

classifying objects - sources of technogenic danger as objects subject to licensing and declaring industrial safety;

analysis of the risk structure and identification of the most critical components;

distribution and standardization of requirements for the main influencing factors, in particular, the levels of stability and security of objects, ensuring the reduction of the risk level to an acceptable level, etc.

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