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THEORETICAL CLASSIFICATION OF EMERGENCIES ARISING FROM FLOODS AND ISSUES OF THEIR PREVENTION (ON THE EXAMPLE OF THE SARDOBA RESERVOIR)

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Abstract

This thesis summarizes the theoretical foundations of flood-related emergencies, their causes and classification, as well as national and international experience in preventing the risks of hydraulic structures, using the Sardoba reservoir as an example.

Keywords: flood, emergency situation, hydraulic structure, risk prevention, Sardoba reservoir.

INTRODUCTION

Among natural and man-made emergencies, floods occupy a special place in terms of their extent and the damage they cause. As a result of climate change, population growth and the increasing intensity of water resource use, a rise in the number of floods and in the severity of their consequences has been observed worldwide in recent decades [3].

In the Republic of Uzbekistan, the abundance of mountain and foothill areas, the intensive spring melting of snow and glaciers, and the presence of large irrigation and reservoir structures are regarded as the main factors that give rise to flood risk.



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The accident at the dam of the Sardoba reservoir in Syrdarya region in 2020 showed once again how real and serious this risk is [1].

The aim of this thesis is to describe systematically the theoretical aspects of emergencies arising from floods, their causes and types, and to summarize existing approaches to preventing the risks of hydraulic structures.

MAIN PART (DISCUSSION AND RESULTS)

Causes and classification of floods. A flood is defined as an emergency associated with the inundation of a certain area when the water level in a river, lake, reservoir or other water body exceeds the normal level. Natural and anthropogenic factors play an important role in its occurrence.

Natural factors include prolonged precipitation, rapid snowmelt, intensive glacier melting, ice accumulation in rivers and the formation of mudflows. In the conditions of Uzbekistan, a sharp rise in air temperature in the spring months causes rapid melting of snow and glaciers in mountainous areas, which leads to an increase in river discharge.

Anthropogenic factors include the narrowing of riverbeds, disorderly construction work, shortcomings in the operation of hydraulic structures and errors in reservoir management. Practice shows that many major accidents occur precisely as a result of the combined effect of natural and anthropogenic factors.

By the nature of their origin, floods are divided into several types: river floods (resulting from a natural increase in discharge), rain floods (resulting from short-term heavy precipitation), mudflows (a mixture of water, mud and stones in mountainous areas), reservoir accidents (resulting from the sudden failure of a hydraulic structure) and urban flooding (resulting from inadequate drainage systems). This classification allows emergency services to plan appropriate measures for each situation in advance.



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Specific hazard features of reservoir accidents. Unlike other types of floods, reservoir accidents are often characterized by their sudden onset and by the spread of a very large volume of water to downstream areas within a relatively short time. This significantly reduces the time available for warning and evacuating the population [5].

The example of the Sardoba reservoir shows that the integrity of a hydraulic structure depends directly not only on the quality of its design and construction, but also on regular technical supervision throughout its long-term operation. For this reason, international practice treats periodic technical inspections, monitoring systems and pre-prepared emergency action plans as mandatory requirements for ensuring reservoir safety [2; 4].

National and international experience in risk prevention. International practice applies an integrated approach to reducing the risk of floods and hydraulic structure accidents. It includes the development of territorial hazard maps, the introduction of early warning systems, regular technical diagnostics of hydraulic structures and training aimed at raising the preparedness of the population.

In countries such as Japan, the Netherlands and the USA, the flood risk management system is based on many years of experience, and engineering measures (dams, embankments and culverts) are implemented in close connection with social and organizational measures (early warning, public training and insurance mechanisms). In particular, periodic safety audits of hydraulic structures and the work of independent expert commissions are an integral part of this system [4].

In recent years, the Republic of Uzbekistan has done significant work to strengthen the system of the Ministry of Emergency Situations institutionally, to improve the regulatory framework for the safety of hydraulic structures and to introduce



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modern monitoring and warning tools [6]. At the same time, the experience of the Sardoba incident showed that existing systems still need further improvement, in particular stronger mechanisms for rapid decision-making and interagency cooperation.

Practical significance of the theoretical analysis. An in-depth study of the theoretical foundations of floods and hydraulic structure accidents is not merely of academic interest: it creates the conceptual basis needed for practical management decisions. A clear classification of hazard types and an understanding of the mechanisms of their occurrence enable emergency services to prepare in advance, allocate resources rationally and form an individual risk profile for each territory. In addition, the results of the theoretical analysis serve as a methodological basis for applied studies carried out at later stages, such as quantitative (mathematical) calculations, hazard mapping and the development of evacuation plans. From this point of view, the classification and analysis presented in this thesis can serve as a starting point for further research.

CONCLUSION

1. Floods are a complex phenomenon arising from the interaction of natural and anthropogenic factors, and their prevention requires an approach specific to each type.
2. Unlike other types of floods, reservoir accidents are characterized by high speed and a large-scale hazard, which calls for special attention to the safety of hydraulic structures.
3. The experience of the Sardoba reservoir incident showed the need to further improve national systems of monitoring, warning and rapid management.



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4. Introducing international experience adapted to local conditions and continuing theoretical and applied research on the safety of hydraulic structures remain among the important ways of reducing the consequences of emergencies.

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