

Risk Assessment and Analysis of Accidents of Water Facilities

Vugar Aliyev^{1,2}, Sabina Magerramova², Aisha Balaeva², Leyla Azeryar²

¹AMIR Technical Services LLC, Apsheron district, Djeyranbatan settlement, AZ-0112, Baku, Azerbaijan

²Architecture and Construction University of Azerbaijan, 15, Sultanova str., AZ-1073 Baku, Azerbaijan

doi: <https://doi.org/10.21467/abstracts.93.5>

ABSTRACT

The article describes the procedure for assessing the risk of accidents at water facilities. The basic requirements for documenting information about accidents, on which analysis and assessment of the risk of accidents at reclamation facilities are based, are given. It was noted that the safety of water facilities is determined by a generalized risk assessment. An analysis of the risk of accidents at water facilities is an integral part of documenting information about the security status of the system. Risk analysis consists in the systematic use of all available information to identify hazards and assess the risk of possible unwanted emergency events. The reliability of the accident risk analysis and its minimization mainly depend on the information received.

Currently, minimizing the risks of accidents of water facilities is included in the sphere of ensuring sustainable development of the country. The development of innovative approaches to documenting the risk assessment of accidents in water facilities involves the development of a monitoring system, forecasting and assessment of natural and industrial risks, regionalization of the territory according to the degree of risk from emergencies, the creation of a unified system of information support for risk management, and much more. Accidents at water facilities can create emergencies, accompanied by loss of life, damage to health, the environment and significant material losses of agricultural land. Water management facilities include reservoirs, water intake facilities, canals, pumping stations, and engineering protection facilities.

When documenting the safety status of water facilities, the main focus is on identifying hazards, accident and catastrophe scenarios, quantifying the risk of accidents of existing structures, the results of calculating the flood zones of agricultural land in the event of the destruction of canals and protective structures, as well as damage assessment. Practice shows that such an assessment of the risks of an accident at water facilities is mainly of a qualitative nature and is insufficient for a quantitative risk assessment. The main tasks in risk analysis are:

- Obtaining objective information about the state of water management facilities;
- obtaining information on the most vulnerable places of water management facilities in terms of health and safety;
- Development of innovative approaches to minimize the risk of accidents.

The risk analysis of the accident of water facilities is carried out in stages: preparation of work and documentation of information, classification and identification of hazards, risk assessment and analysis, and the development of a package of measures to minimize the risk of accidents. The results of the assessment and analysis of the risk of accidents at water facilities largely depend on the correct classification and identification of hazards. In the classification and identification of hazards are determined main hydraulic structures and technological processes requiring the most serious analysis. The classification and identification of hazards results in a list of scenarios for the occurrence of undesirable events, a description of the sources of danger and risk factors, a preliminary assessment of hazards and risk.

When assessing and analyzing risk, the following tasks are set:



- determination of the frequency of occurrence of accidents in water facilities;
- assessment and analysis of the consequences of accidents;
- generalization of risk assessments and their analysis.

To determine the frequency of occurrence of accidents in water facilities, statistical data on accidents and expert estimates are used. In world practice, according to the recommendations of ICOLD (International Commission on Large Dams), it is recommended to assess the risk in the form of a mathematical expectation of the consequences of the implementation of an undesirable event (as the product of the probability of a negative event and the mathematical expectation of the magnitude of its consequences) or in the form of a certain combination (scenario) of implementation probabilities and associated with him the consequences. Thus, the risk depends on the probability of a building accident and on its consequences and often represents a significant amount, even if the probability of an event is very small. The traditional approach to solving the problem of compliance of water facilities with safety requirements is based mainly on the deterministic method of limit states (or limit equilibrium), which reduces, in principle, to a comparison of the calculated (deterministic) indicators with their acceptable (criteria) values. Estimated indicators are refined using systems of safety factors.

Accident risk characterizes a more complete hazard statement, including the probability of a hazardous event and an assessment of the negative consequences associated with it. The reliability of hydraulic structures means the fulfillment of functional (technological) requirements by them during the standard service life. The development of risk reduction recommendations is the final step in risk analysis. The recommendations provide reasonable measures to minimize risk, which are based on the results of risk assessments and analysis. Crucial is the overall assessment of the effectiveness and reliability of measures affecting the risk, as well as the size of the costs of their implementation.

Evaluation of the effectiveness of the proposed risk reduction measures is as follows: with the given funds, it is necessary to ensure the maximum risk reduction of the operated water facilities or to ensure that the risk is reduced to an acceptable level at the lowest cost. To determine the importance and priority of the implementation of measures to minimize the risk of accidents in water facilities, it is necessary to determine “the effectiveness-cost” indicator and evaluate the effectiveness of the proposed measures according to the criteria of diagnostic safety indicators that determine the reliability of the water facilities.