ABSTRACT

to the dissertation of Alsheriyev Erdaulet Turysbekuly for the degree of Doctor of Philosophy (PhD) on the topic: «Development of measures for the safety of the population of the Turkestan region in emergency situations of natural and man-made nature» educational program 8D11210 –«Life safety and environmental protection»

Relevance of the research work. The National Security Strategy of the Republic of Kazakhstan is one of the main documents of the new system of state plans, introduced on behalf of President Kassym-Jomart Tokayev, and requires systematic strengthening of efforts to prevent natural and man-made disasters and minimize their consequences. The main strategic goal is to protect the population, society and the state from emergencies in natural and man-made conditions.

It shows that in recent years, in the territory of the Republic of Kazakhstan, in natural and man-made emergencies, the scale of disasters has increased, mortality and material damage have increased. Natural and man-made disasters not only affect human life and health, but also cause economic losses. Disruption of the economic situation of the country, along with the elimination of the emergency situation, leads to a decrease in the economic sphere of the area. In particular, the decrease in the ecological situation of the territory and the depletion of natural resources directly affect the economic condition of the country.

The legislative framework for the prevention of natural and man-made measures that reduce the environmental situation in the Republic of Kazakhstan and the elimination of the disaster needs to be further supplemented. Therefore, the protection of the population and the region from natural and man-made emergencies (forecasting, prevention, elimination and calculation of accidents that have occurred) is an urgent problem today.

The object of the study is 17 cities/districts of the Turkestan region that pose a risk of natural and man-made emergencies, 6 of the most dangerous reservoirs in terms of water volume out of 40 public reservoirs, 3 chemical and 11 radiation-hazardous facilities.

The subject of the research is a mathematical model and a web application based on calculations and the consequences of projected human, material and social losses in the territories where a natural disaster occurs.

Research methods. Methods for determining losses by assessing engineering and seismic vulnerability, depending on the type of construction of buildings in the territory, have been applied, with the preparation of a seismic active map of the region using seismic microzoning and hydrodynamic calculations to determine the wave height and area of the waterway in case of possible destruction of reservoirs.

The purpose of the scientific work is to assess the impact of possible consequences of natural and man-made emergencies on the settlements of the Turkestan region.

To achieve this goal, the following tasks were set:

- determination of earthquake losses in populated areas of the Turkestan region;
- creation of flood zones due to the destruction of 6 of the most dangerous reservoirs out of 40 reservoirs in the event of an earthquake in the region;

- calculation of the amount of destruction of engineering structures in the event of an earthquake in the region;

- calculation of possible man-made accidents at production facilities;

- development of measures to ensure the safety of the public in the event of an estimated seismicity of 6-7-8 points.

- development of a software application that analyzes the material, social and other costs of natural and man-made emergencies that are possible according to the calculations performed.

Scientific novelty of the results obtained in solving research problems:

1) the objects of individual housing construction, administrative facilities, industrial facilities, utility and energy networks, roads and roadside engineering structures, strategic facilities and possible human losses that may occur in the event of an expected earthquake of magnitude 6-8 in the Turkestan region are analyzed;

2) the area of flooding of settlements and the population in them are calculated based on the scenario of dam failure in 6 dangerous reservoirs;

3) various degrees of damage to engineering life support systems have been identified in possible earthquakes of 6-8 points;

4) safety measures have been developed in the context of a suspected natural and man-made emergency in the Turkestan region.

5) mathematical modeling calculations have been performed to determine costs based on the identified predicted damage indicators and a web application has been developed that works online based on computer programming.

The practical significance of the work. A web application has been developed for modeling the analysis of projected engineering damage and losses in the Turkestan region based on pre-calculated data on the effects of natural earthquakes (population in settlements, engineering structures, production facilities, population).

The results obtained during the dissertation research include: a map of the seismic zoning of the region; information for each district on human and sanitary losses occurring in the destruction zone due to natural and man-made emergencies; information on all residential and industrial facilities subject to possible damage; indicators of chemical and radiation contamination at chemically hazardous facilities; measures carried out by the regional Department of Emergency Situations to prevent and eliminate the consequences of emergency situations; the results of practical application during rescue operations.

Approbation of scientific results in practice. The results of the conducted research on forecasting the consequences of natural and man-made emergencies that may occur in the territory of the Turkestan region were conducted on the basis of an act (appendices A and B) in the Department of Emergency Situations of the Turkestan region and jointly with the state utility enterprise under the right of economic management Turan Su of the Department of Agriculture of the Turkestan region.

In addition, the achieved research results have been introduced into the educational process for students, undergraduates and university applicants in the disciplines of «Modern aspects of testing the strength of buildings and structures for earthquake resistance» and «Safety of life» (appendices V and G).

The validity and reliability of scientific results, conclusions and recommendations gathered from measures to ensure public safety in natural and man-

made emergencies are confirmed by the results of the author's research obtained in industrial conditions.

Basic scientific principles recommended for protection:

- the scenario of possible consequences of an alleged earthquake of magnitude 6-8 in the territory of the Turkestan region;
- organization of emergency rescue operations and decision-making on evacuation of the population from dangerous areas of the region in case of emergency situations;
- a web application designed to analyze projected costs based on research data, information about utility networks, and demographic data.

Scientific publications. Based on the results of the dissertation, 7 printed scientific articles were published. Of these, 2 articles have been published in journals included in the Web of Science/Scopus database (quartile-Q2, Q3), 5 articles in the materials of international, national conferences, periodicals.

The volume and structure of the dissertation work. The thesis consists of an introduction, 5 chapters, a general conclusion, a list of references and 4 appendices. The 158-page dissertation includes 64 figures and 34 tables. The list of references consists of 123 sources.