

BURNING PROBLEMS OF MODERN UKRAINE AND THEIR REFLECTION IN THE ATLAS OF EMERGENCY SITUATIONS

RUDEENKO L.

Institute of geography of NAS of Ukraine, KIEV, UKRAINE

SUMMARY

The development of the Atlas of Natural, Technogenic and Social Hazards and Risks of Emergency Situations is stipulated by the increasing risk of arising of such situations in the country. Conceptual foundations of Atlas creation are stated. World hazards and disasters mapping experience, principles of mapping and approaches to forming of a database, possible technological decisions and references were analyzed during the process of Atlas creation with the final results being offered in the article.

INTRODUCTION

General trends of the deterioration of natural conditions of life activity of the population in Ukraine and other European countries are reinforced by the factor of low level reequipment of economy.

Fixed assets depreciation and old technologies increase the negative impact on the environment not only because of emissions and dumping of pollutants, but also by the way of activity of potentially dangerous enterprises as well as production and accumulation of hazardous wastes. By various estimates, there are about 15 thousand of potentially dangerous objects functioning in Ukraine, approximately 800 million tons of wastes are produced annually, with the total amount of about 36 billion tons. About 21 million tons of such wastes belong to I - III hazard classes. There are approximately 2.3 million m³ of empty rock dumps located in mining enterprises, and over 2.5 billion tons of waste products of ore beneficiation processes are accumulated in the tailing dumps.

It's generally known that critical ecological conditions of nature components make comprehensive negative influence on the human health.

Imperfect technology, high power-intensity and material capacity, physical and moral depreciation of production facilities, significant concentration of objects of explosive, chemical, fire, hydrodynamic and biological hazards, presence of emergency state accommodation, obsolescence and depreciation of transport system, etc. determine the risk of emergency situations (hereinafter – ES) in different regions of Ukraine. Unfortunately, the frequency of the display of ES have increased, what results often in losses of people lives and direct and indirect state economy losses. Therefore, the maintenance of population safety currently is a key issue of administrative bodies at the regional and state levels.

Cartographic study of the spatial peculiarities of distribution of hazards and risks is an important way of geographic prediction for the prevention of emergency situations in Ukrainian territory. Modern system geoinformation mapping is based on the creation of divided geographic databases that form the basis for making of the atlas products, map systems or development of interactive geographic information systems (GIS). Because of the unification of traditional geographic mapping modeling with database structure implementation, the new object of the research arises. It has to be researched by means of geoinformatics, cartography and geography. Development of geographic databases for ES risks mapping in Ukraine is one of the important areas of such a research.

The goal of the development of the Atlas of hazards and disasters in Ukraine is the ***generalization of the overviews about the possibility of the emergency situations and development of the hazards and disasters to ensure the availability of visual perception and analysis of this information to a large range of users, including representatives of state and local government, teachers, researchers, civil society and international community.***

To fulfil this goal, the following tasks should be implemented:

- a) The development of the database of potentially dangerous events, objects and processes that are (or can be) the driving factor in forming of emergency situations risks;
- b) The creation of spatially organized cartographical models concerning the possibilities of ES risk of natural, technological, environmental, social and medical-biological genesis;
- c) The creation of the prototype of real-time functioning GIS for the assessment of factors that may cause the hazards and disasters in the regions of Ukraine.

Obtaining of spatial and systematic interpretation of knowledge about the conditions of the ES origin and activities of society that have to prevent ES development is a matter of state importance. Such information

contributes to the development of proactive measures which help to prevent the emergence and eliminate the consequences of disasters, purposefully inform citizens about the risks of emergency situations. It allows to evaluate the existence of deviations from the normal condition of natural or engineering objects, the hazards of their destruction, and possible human deaths or disruption of conditions of human life, causing direct and indirect damages, degradation of environmental characteristics of natural components.

To reduce losses and damages from anthropogenic and natural disasters, the quick and reliably forecast of disasters and their consequences should exist. It will help to prepare economically reasonable countermeasures at the national and regional levels. The safety of the population in areas of high technological and natural hazards should be based on reliable and complete information about the conditions of its social safety. In present conditions of the interdependence of economic, social and environmental processes, the local government needs to have adequate tools for monitoring of the conditions of the objects and regions to anticipate hazards and adopt alternatives, substantiation of measures for minimization of possible losses and unproductive expenditures. Such tools can be found in modern GIS technology which provides the necessary information for effective management decisions in the sphere of prevention and response to emergency situations of various origins. The principal advantage of these technologies is the possibility of complex information display and operation with spatially distributed, heterogeneous and dynamic factors of engineering, environmental and social hazards, with the account of their interconnection and interaction on all levels of management.

Principles of cartographical modeling of emergency situations. We recognize that people live in anthropogenic landscape, which is an environment that was changed by human activities during the implementation of socio-economic functions based on the appropriate nature management technology. Complexity of phenomena and processes in this landscape requires the consideration of all of their characteristics that form the conditions of human life, and in our case - the disclosure of factors that may cause the emergency situation. The core matter of this work is the development of the relevant principles of cartographic modeling of ES. The main of them are the following:

- the principle of purpose - mapping process should be focused on the detection and spatial display of the main factors affecting formation of the conditions, emergence, and preventive measures and eliminating of consequences of emergency situations;
- the principle of integrity and poly-structural properties that promotes full analysis of interdependences and interactions between different objects, phenomena and processes;
- the principle of selectivity, which should be observed in research and evaluation of various types of ES (natural, anthropogenic, etc.);
- the principle of partial irrelevance, when the perception of the object or phenomenon in the process of direct interaction differs from the system of signs that is used to display this object or phenomenon on maps with certain conventions and directed generalization, when the inclusion of new additional information leads to the possibility of significant increase of the number of characteristics that can be observed, comparing with their number in the case of direct observation of the objects (economic, social indicators, etc.);
- the principle of geosystems structuring and division, which promotes purposeful mapping and spatial research of specific factors, that cause the risk of natural, engineering and other emergency situations;
- the principle of accuracy (reliability) of the information based on statistical data, results of field studies and research activities;
- the principle of efficient providing of sign combinations that form map images of evaluation of the preconditions of possible emergencies origins connected with existing natural and technical objects and phenomena.

Levels of mapping. In the Atlas information about objects and events is structured according to specific levels of its representation, from which the spatial and content are the main ones.

Spatial information is structured according to the characteristics of phenomena on the Earth surface (on land and water areas), underground and in the lower atmosphere. Characteristics of phenomena of the Earth surface will be highlighted locally (for different objects) and regionally (within settlements, districts and provinces).

Time characteristics in the mapping of objects and phenomena are conditioned by several circumstances: the time of the design of the Atlas, time of occurrence or display of a specific phenomenon, time for reasonability of placing of separate parameters that characterize some time sections of processes or phenomena.

The Conception of the Atlas is oriented towards the development and production of its electronic version with the possibility of the creation of classical paper version. It is well known that the scale of maps in the electronic version can be zoomed in or out. If we need to display some detailed characteristics of the objects, phenomena or processes and fit them to a geographic basis, we must define the basic scale of the Atlas maps. When choosing the scale we need to consider such already known factors as the detailed results of research facilities related to the thematic content of the Atlas, its purpose, relevance, reasonability of coordination of the maps with previous editions, the configuration of the territory of Ukraine, the directions of Atlas maps use etc.

Experience of the creation of the National Atlas of Ukraine in paper and electronic form, proves that the main scale should be 1:2 500 000. Larger and smaller scales may be derived from it.

Approximate Structure of the Atlas of Natural, Anthropogenic and Social Hazards and Risks of Emergency Situations in Ukraine

Introduction

Text

Maps:

Administrative division.

Physical surface.

Emergency situations (European and worldwide).

Population settlement (tables: quantitative changes, characteristics of country's biggest cities, etc.).

Gross Regional Product and emergency situations.

The vulnerability of regions to emergency situations.

The monitoring system (quality control and risk assessment).

Section 1. Natural hazards and risks

The risk of natural emergency situations (on the level of objects, local, regional, national levels).

The risk of emergency situations related to hazardous geological processes

The seismic influences hazards.

The hazards of gravitational processes (landslides, avalanches and screes).

The hazards associated with faults.

The hazard of wind erosion.

The hazard of abrasion.

The hazard of flooding.

The hazard subsidence of crust.

The hazard of karst gaps.

The hazard of ravine erosion.

The hazard of emergencies caused by weather phenomena.

The hazard of strong winds, squalls and tornadoes.

The hazard and risk of severe thunderstorms and large hail.

The hazard and risk of heavy rains.

The hazard and risk of heavy snowfalls and snow drifts.

The hazard and risk of black ice.

The hazard and risk of intensive blizzard.

The hazard and risk of intensive frost.

The hazard and risk of heat wave.

The hazard and risk of dense fog.

The hazard of droughts.

The hazard of frost.

The hazard of emergency situations caused by hazardous hydrological phenomena

The hazard of emergency situations of hydrological (marine) origin.

The hazard of flooding and rain-caused flash floods.

The hazard and risk of shortage of water in the rivers.

The hazard and risk of avalanches. Ukrainian Carpathians. Mountain Crimea.

The hazard of fires in natural ecosystems.

Section 2. Technological hazards and risks

The risk of anthropogenic emergency situations (on the object, local, regional, national levels).

The hazard and risk of emergency situations in transport system (motor, rail, air, water and pipeline transport).

The hazard and risk of emergency situations on the objects of fuel industry (coal industry, oil drilling and gas extraction industry).

The hazard and risk of emergency situations in power systems (nuclear, hydro and thermal power stations, transmission lines).

The hazard and risk of emergency situations in metallurgy, machine building, chemical, petrochemical, oil refining industry.

The hazard and risk of emergency situations on the objects of housing and communal services (water supply and sewerage systems, heat networks, municipal pipelines, etc.).

The hazard and risk of emergency situations in communication systems and telecommunications.

The hazard and risk of emergency situations caused by sudden collapse of buildings.

The hazard and risk of emergency situations of anthropogenic fires.

The hazard and risk of emergency situations on refineries.

The hazard and risk of emergency situations on hydraulic works.

Section 3. Ecological hazards and risks

The hazards and risks arising from Chernobyl accident in 1986.

The hazards and risks caused by regional climate changes.

The hazards and risks arising from water deficit.

The hazards and risks caused by pollution of nature components.

The hazards and risks of agro-climatic nature.

Section 4. Social hazards and risks

The hazard and risk of property conflicts.

The hazard and risk of ethnic conflicts.

The hazard and risk of increased crime due to:

- spread of alcoholism and drug addiction;
- illegal migration;
- unemployment;
- protests against the activities of transnational companies;
- antiglobalistic movements;
- spread of the influence of some religious confessions;
- other events.

Section 5. The risks of medical and biological emergency situations

Demographic trends.

The primary morbidity of the population.

The hazard of active tuberculosis morbidity.

The hazard of diseases caused by HIV and AIDS.

The hazard of emergency situations associated with poisoning of people.

The hazard of emergency situations caused by infectious diseases of farm animals.

The hazard of emergency situations caused by affection of crops with diseases and pests.

Section 6. The hazard and risk of emergency situations on the objects of strategic importance to the national economy

Objects that are of strategic importance to the state economy.

Potentially dangerous objects (radiation, chemical, explosion and fire hazards), potential threats, predicted damage zone).

Vulnerability of strategic objects to the impact of natural hazards.

The Autonomous Republic of Crimea, Vinnytsya region, etc.

Section 7. Organization of preventive measures and possible ways of emergency situations elimination

Organization of the System of prevention of possible accidents (the system of response to the emergency situations, subdivisions of the Ministry of Emergency Situations of Ukraine, management system).

Search and Rescue Service (composition, location, etc.).

Monitoring System (the network of monitoring and laboratory control).

Participation of structures of the Ministry of Emergencies in ES liquidation outside of Ukraine.

Economic, logistical and financial support systems to prevent the emergencies.

Scientific support of the ES prevention system.

Section 8. Chronology of emergencies in Ukraine 1991 – 2005.

CONCLUSION

The Atlas Structure is aimed to display, first of all, the sources of emergency situations and possible conditions of their development, which may have different duration. The objects of dominant influencing factors should be drafted and put in the final form during the creation of maps for each part of the Atlas. The “hazard” and “risk” terms are understood as closely interconnected concepts that reflect the current probability of occurrence of negative events or process in a particular location, which may lead to the various economical losses, human health deterioration, or changes in human life conditions.

REFERENCES

1. Державний класифікатор надзвичайних ситуацій (ДК 019-2001). – К.: Держстандарт України, 2002.
2. Карта «УСССР. Неблагоприятные природные процессы и явления», масштаб 1:750 000 / Руденко Л.Г. и др. – М., НРКП ПКО «Картография», 1986.
3. Котляков В. М., Трофимов А. М., Хузеев Р. Г., Борунов А. К., Гнеденков Л. Н., Селиверстов Ю. П. Географический подход к теории катастроф //Изв. Российской АН. Сер. геогр., – 1993. – № 5.
4. Лисиченко Г.В., Забулонов Ю.Л., Хміль Г.А. Природний техногенний та екологічний ризику: аналіз, оцінка, управління / НАН України; Інститут геохімії навколишнього середовища. — К.: Наук. думка, 2008. — 542 с.
5. Bin O., Dumas C., Poulter C., Whitehead J. A GIS Approach to Measure the Impacts of Sea Level Rise on Coastal Real Estate in North Carolina, The 21st International Conference of The Coastal Society, 2008.
6. Choi Y J, Kim H K, Baek W P, Chang S H. Hybrid accident simulation methodology using artificial neural networks for nuclear power plants[J]. Information Sciences, 2004, 160(1–4):207–224.
7. Derekenaris G, Garofalakis J, Makris C, Prentzas J, Sioutas S, Tsakalidis A. Integrating GIS, GPS and GSM technologies for the effective management of ambulances[J]. Computers, Environment and Urban Systems, 2001, 25(3):267–278.
8. Kwan M., Lee J. Emergency response after 9/11: the potential of real-time 3D GIS for quick emergency response in micro-spatial environments[J]. Computers, Environment and Urban Systems, 2005, 29(2):93–113.
9. Lovgren S. New Hazard Maps Show Most At-Risk U.S. Communities for National Geographic News. – February 12, 2008.
<http://news.nationalgeographic.com/news/2008/02/080212-hazard-maps.html>
10. Luchette J., Crawford T. A public participation GIS application for citizen based watershed monitoring in the Pamlico-Tar River Basin, North Carolina,” Southeastern Geographer, 2008.
11. van Oosterom P., Zlatavona Siyka, Fendel E.M. (eds), 2005, Geo-information for Disaster management, Springer-Verlag ed., 1434 p.
12. White G.F. Natural hazards research: concepts, methods and policy implications / White G.F. - New York; London, Toronto, 1974., P.3-16.