Державна служба України з надзвичайних ситуацій

Черкаський інститут пожежної безпеки
імені Героїв Чорнобиля
Національного університету цивільного захисту України

Матеріали XV Міжнародної
науково-практичної конференції

«ТЕОРІЯ І ПРАКТИКА ГАСІННЯ ПОЖЕЖ ТА ЛІКВІДАЦІЇ НАДЗВИЧАЙНИХ СИТУАЦІЙ»

25 квітня 2024 року

Черкаси – 2024

ENVIRONMENTALGEOPHYICAL AND FIRE SAFETY STUDY ON THE BLACK-BALTIC SEAS WATERWAYS

Yuriy STARODUB, Doctor of Physical and Mathematical Sciences in geophysics, Professor,
Borys MYHALICHKO, Doctor of Chemical Sciences, Professor,
Helen LAVRENYUK, Doctor of Technical Sciences, Associate Professor,
Andrii HAVRYS, PhD, Associate Professor, Roman HUSHCHAK, Senior Lecture,
Lviv State University of Life Sciences,
Bogdan KUPLYOVSKYI, PhD, Senior Scientific Researcher,
Institute of Geophysics, National Academy of Sciences,
Henryk POŁCIK, PhD, Senior Scientific Researcher,
Foundry Research Institute, Kraków, Poland

The investigation aims to develop a geological and geophysical information system for monitoring emergencies, creating a database with the localized placement of engineering objects along the flow lines of the rivers in the direction of the Dniester - Western Bug to the border with Poland emergency monitoring that will enable the consequences of various natural and man-made hazards and fires to be predicted in good time and thus help to prevent their occurrence. This includes potential fires the possibility of fires causing air, water, and soil pollution, as well as destruction in flood-prone areas, collect, through monitoring, data that will allow effective protection of equipment, coasts, structures, mountain roads, bridges, tunnels, dams and buildings located on soils with unique geological and geophysical features that could lead to air, water and soil pollution by hazardous substances, as well as situations where there is a risk of flooding, requiring the protection of coastlines, buildings, roads on mountain slopes, bridges, tunnels and dams built on soils with natural geological and geophysical characteristics. The necessity to collect data through monitoring arose that will allow for effective protection of equipment, banks, structures, mountain roads, bridges, tunnels, dams, and buildings located on soils with unique geological and geophysical features existing and planned. These will help to coordinate the efforts of civil and fire protection services, increasing the efficiency of response to emergencies. To deal with environmental and geophysical emergencies, it has been necessary to develop practical algorithms for the protection of infrastructure facilities, which are used by civil protection and fire and rescue services based on available software that has been used with the help of scientific partners. These activities include the evaluation of the effectiveness of emergency and rescue measures, as well as the development of new software products and the improvement of existing technologies for their operation. The geological and geophysical information system was developed to enhance emergency response efficiency by coordinating civil and fire protection services.

Seismically active regions, such as Ukraine, are predisposed to fire hazards. The monograph [1] describes methods for detecting and assessing forest fires using data from artificial Earth satellites. Based on the results of geological monitoring of hazardous situations related to the occurrence and spread of fires, technologies have been applied to protect natural and industrial facilities and engineering structures from the destructive effects of fire. Grounded on the current state of the problem, the goals and objectives of the planned investigation are to create a geological information complex (system) and develop polymer-based fire protection materials. A new type of fire-protection coating for wood and metal was created, and a composite material with reduced fire hazard based on modified epoxyamine compositions was developed with this aim. The widespread use of these materials makes it possible to effectively prevent the occurrence and spread of fires for the selected objects and regions, which are often the result of natural and man-made emergencies with a negative impact on the environment.

The development aims to support: the analysis, emergency prediction, and fire hazard assessment for the studied areas and high-risk facilities. These tasks will form the

basis for operational decision-making by civil and fire protection services. This includes the mapping of hazardous facilities [2], the accounting and classification of water supply resources (including the location of hydrants, shelters, and other structures [3], and the fire protection of facilities and structures with modern fire protection materials.

The development includes, at certain stages, the need to take into account the state of natural hazards and anthropogenic loads, statistical processing of data on emergencies and fires, modeling of the spread of fires and emergencies in hazardous areas, study of the processes of flooding, emissions and discharges of pollutants with release of harmful substances, in particular along river courses. The scheme will focus on the causes of fires in natural ecosystems and their spread to civilian objects, soil dynamics, and possibly other natural and man-made hazards along the water river lines. In an additional phase, it is planned to investigate the fire and hydrogen safety of power plant turbine halls, fire-resistant lubricating and cooling fluids, and to use the theoretical basis for modifying functional materials for extreme applications.

In conclusion: the objective of the investigation is to create a unique geological and information system for monitoring emergencies, which will allow timely prediction of the consequences of natural and man-made hazards and their prevention.

LITERATURE

1. Starodub Y., Kuplyovskyi B., Brych T., Havrys A, Yemelyanenko S. Computer simulation of natural and technological hazards and environmental-geophysical situations. L'viv: Rastr-7, 2023. – 212 p. https://sci.ldubgd.edu.ua/jspui/handle/123456789/11596].

2. Гаврись А., Яковчук Р., Стародуб Ю., Тур Н. (2023). Управління ризиками виникнення надзвичайних ситуацій, пов'язаних із затопленням територій на рівні об'єднаних територіальних громад. Науковий вісник: Цивільний захист та пожежна безпека, (1 (15), 101–109. Https://doi.org/10.33269/nvcz.2023.1 (15).101-109.

3. Starodub Y., Karabyn V., Havrys A., Kovalchuk V., Rogulia A. & Yemelyanenko S. (2022). Geophysical research in the pre-Carpathian hydrosphere situation for the environmental civil protection purposes. Geofizicheskiy Zhurnal, 44(4), 171–182. https://doi.org/10.24028/gj.v44i4.264847.