

*S.Ya. Kravtsiv, teacher-methodologist, NUCDU,  
O.M. Sobol, DSc., Senior Research, NUCDU,  
A.V. Maksimov, lecturer, NUCDU*

## **THE ANALYSIS OF INTEGRAL RISKS ON THE TERRITORY OF UKRAINE**

This work conducts the analysis of the main integral fire risks on the territory of Ukraine. There is the identification of the administrative-territorial unit with a high level of these risks, as well as a comparison of specific indicators of the impact of the fires in Ukraine with similar indicators for other countries. It is noted that further research will be focused on the development of models of integrated management of fire risk with the aim of reducing the number and minimizing the socio-economic impact of fires.

**Keywords:** integrated fire risk, fire safety, risk management.

**Statement of the problem.** Increase of the degree of protection of the population and territories from emergency situations, reduction of risks and minimization of consequences of emergency situations of anthropogenic and natural character is one of the priority tasks of the unified state system of civil protection.

According to the results of the analysis of functioning of the unified state system of civil protection, the introduction of modern principles of regulation in the sphere of anthropogenic and natural security is slow in Ukraine [1]. Thus, there is an actual scientific and applied problem of the development of theoretical basics of risk management of emergency situations of anthropogenic and natural character and implementation of the risk-based approach of reducing the number and minimizing the socio-economic consequences of emergency situations, ensuring a guaranteed level of safety of citizen and society.

One of the tasks, solution of which will contribute to the solution of this problem, is the analysis of integral fire risks on the territory of Ukraine with the purpose of revealing of administrative-territorial units, for which the acute problem is of providing an adequate level of fire safety, identification of factors affecting the level of overall fire risks, and the management of these risks.

**Analysis of recent researches and publications.** The legal basis for the decision of risk management problems of emergency situations is the order of the Cabinet of Ministers of Ukraine dated 22.01.2014 №37-p, which approved the Concept for managing the risk of emergency situations of anthropogenic and natural character [1]. The paper substantiates the

necessity of the introduction of the conceptual bases of emergency situations risk management, the implementation of the Concept, solutions to problems, the principles of risk management, indicated normative levels of risk and identifies the expected results from the implementation of the Concept. However, there are problematic issues that require immediate solution for the practical implementation of the Concept of risk management of emergency situations of anthropogenic and natural character, including: the interpretation of the term "risk of emergency", the provision of risk classification, development of methods for assessment and regulation of risks and risk management techniques [2].

With regard to the definition of the term "risk", this question was studied, for example, in [3, 5, 6], directed to the study of integral fire risks, devoted to the scientific works of Professor M. M. Brushlinsky [7, 8,].

**Statement of the problem and its solution.** The aim of this work is the analysis of integral fire risks on the territory of Ukraine with the purpose of revealing the administrative-territorial units, for which the problem is the one of ensuring an acceptable level of fire safety.

First of all, let us consider the definition of the term "fire risk". According to [6], a fire risk is a quantitative characteristic of a possible implementation of fire hazard (and its effects), measured, typically, in appropriate units.

The management of fire risk – elaboration and implementation of complex activities (engineering, economic, social or other nature), which allows to reduce the value of this fire risk to a tolerable (acceptable) level.

An admissible fire risk – a fire risk, the level of which is valid and justified on the basis of socio-economic conditions.

In his research prof M. M. Brushlinsky detects local and integral fire risks [4, 5, 6]. Local risks characterize the dangers inherent to such objects as businesses, vehicles, etc. Integrated risk describes the complex threats such large and complex objects of protection as cities, regions, countries, and includes elements of buildings, infrastructures, various businesses, transport networks, etc., i.e. they take into account and "summarize" all local risks inherent to these systems.

Consider the basic integral fire risks:

1) the risk for humans to be in the fire for the year averagely, *fire/thousand of people·year*

$$R_1 = \frac{N_{\text{fire}}}{N_{\text{people}}}, \quad (1)$$

where  $N_{\text{fire}}$  – number of fires per year, *fire/year*;  $N_{\text{people}}$  – population number at the beginning of the year, *thousand of people*;

2) risk for a person to die in a fire (2), *victims/10 fire·year*

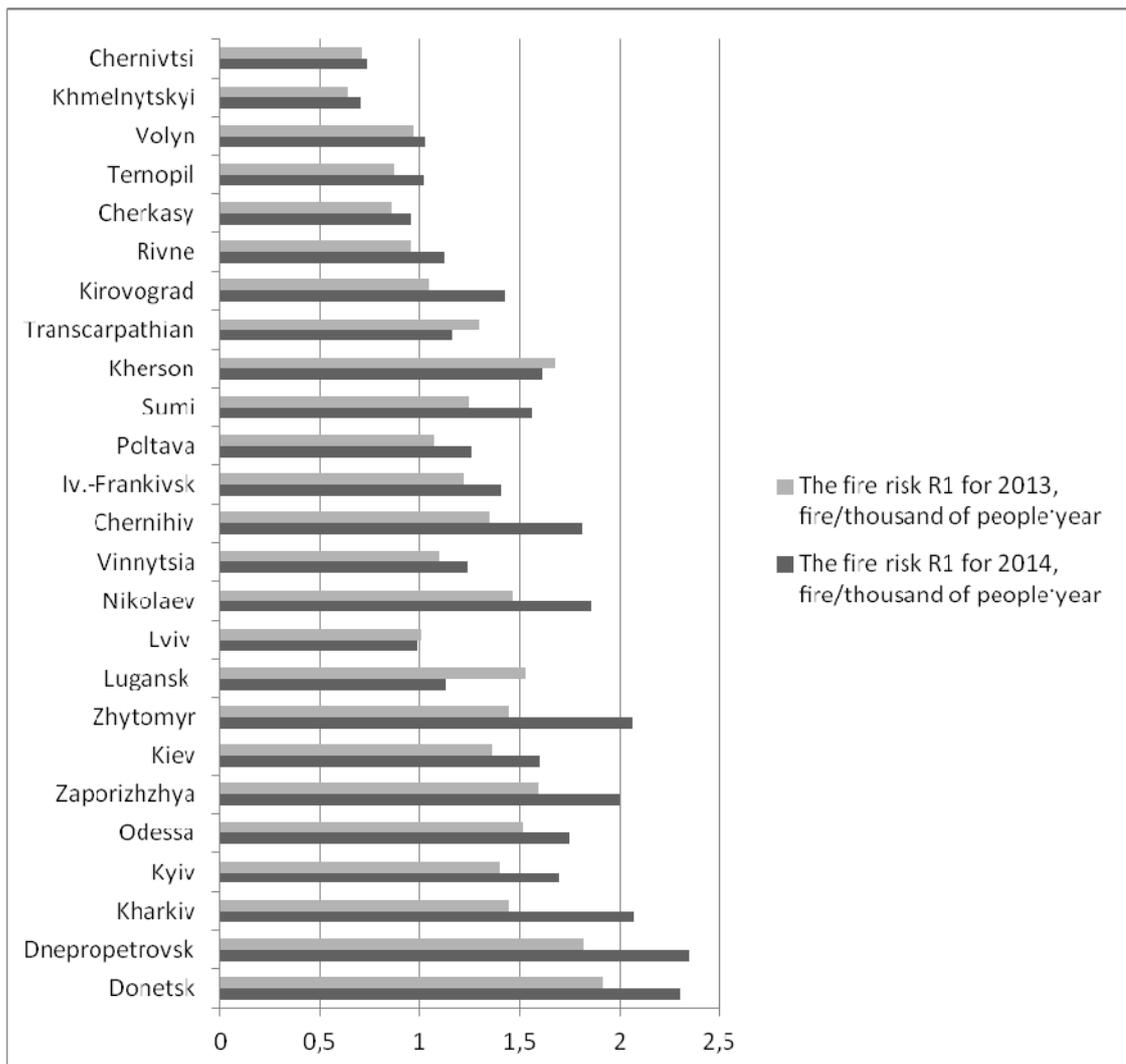
$$R_2 = \frac{10 \cdot N_{\text{victims}}}{N_{\text{fire}}}, \quad (2)$$

where  $N_{\text{victims}}$  – the number of victims per year, *victims/year*;

3) a person's risk of dying in a fire during the year (3), *victims/10 thousand of people·year*

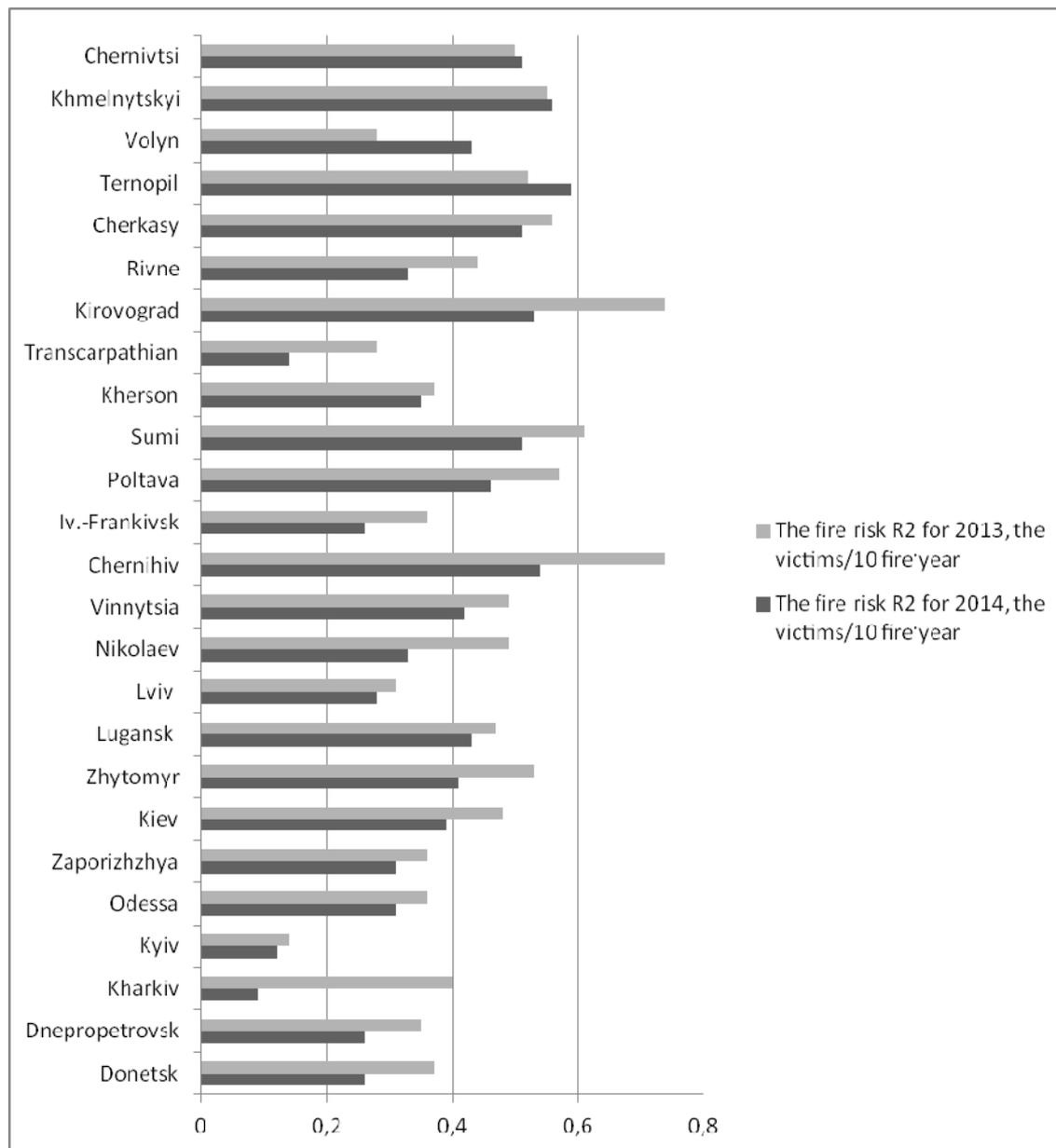
$$R_3 = \frac{10 \cdot N_{\text{victims}}}{N_{\text{people}}}. \quad (3)$$

On the basis of statistical information about the number of fires that occurred on the territory of Ukraine for 2013-2014, and their effects [4, 9], a calculation of main fire risks (1)-(3) was produced for the administrative-territorial units of Ukraine (Fig. 1-3).



**Fig. 1. Fire risk  $R_1$  for the feedback./thousand people a year**

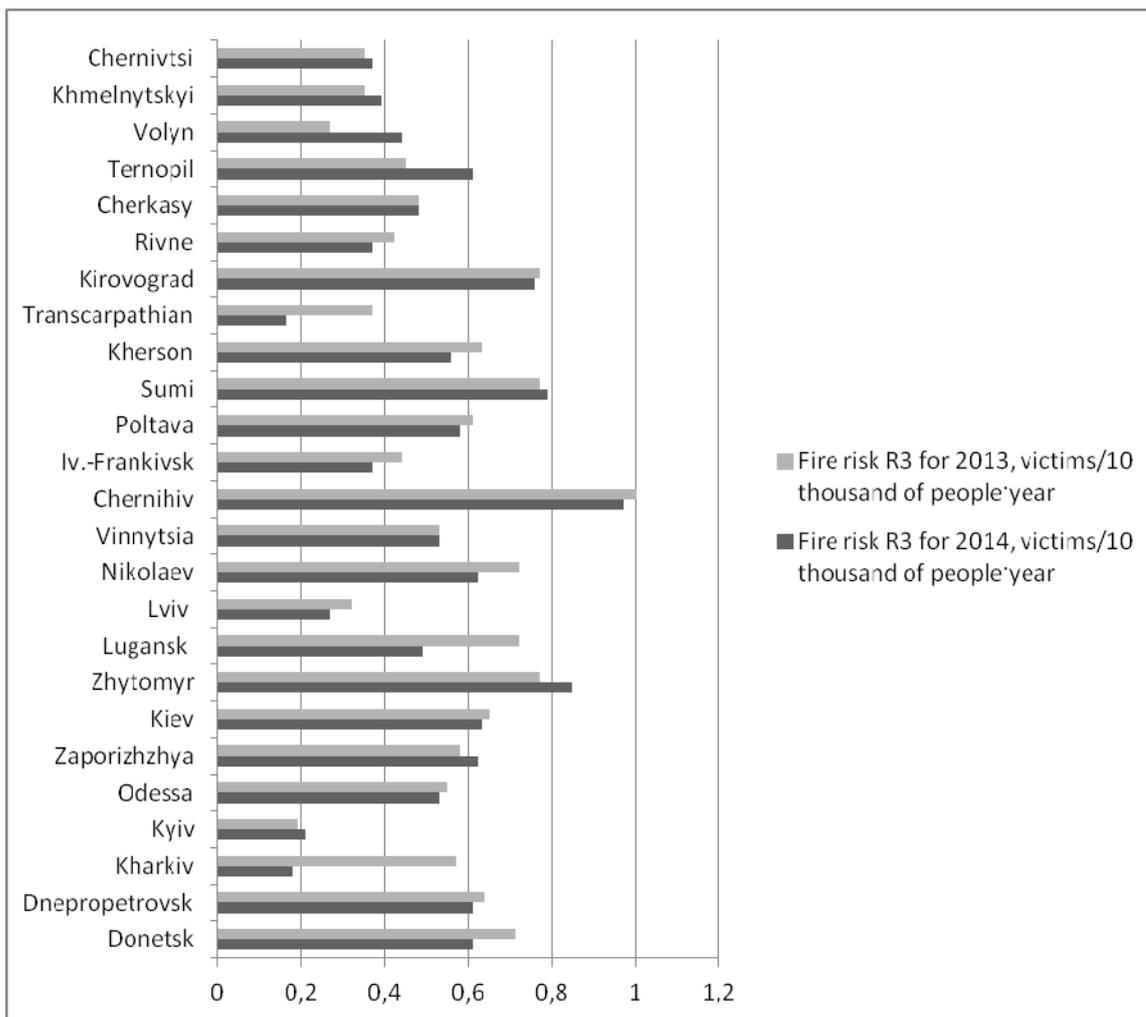
The analysis of calculations of the integrated fire risk  $R_1$ , shown in Fig. 1, shows that the highest level of this risk is observed in Donetsk, Dnipropetrovsk, Kharkiv, Zhytomyr and Zaporizhzhya regions. Moreover, in 2014, there has been an increase in the level of the given risk compared with 2013.



**Fig. 2. Fire risk  $R_2$ , victims/10 fire year**

With regard to the  $R_2$  integrated fire risk, according to Fig. 2, it can be concluded that the highest level of this risk is observed in Ternopil, Khmelnytskyi, Chernihiv, Kirovograd, Sumy, Chernivtsi and Cherkasy regions.

The highest level of the  $R_3$  integrated fire risk (Fig. 3) is recorded in Chernihiv, Zhytomyr, Sumy and Kirovohrad regions, indicating the presence of problems in ensuring an acceptable level of fire safety.



**Fig. 3. Fire risk  $R_3$ , victims/10 thousand of people · a year**

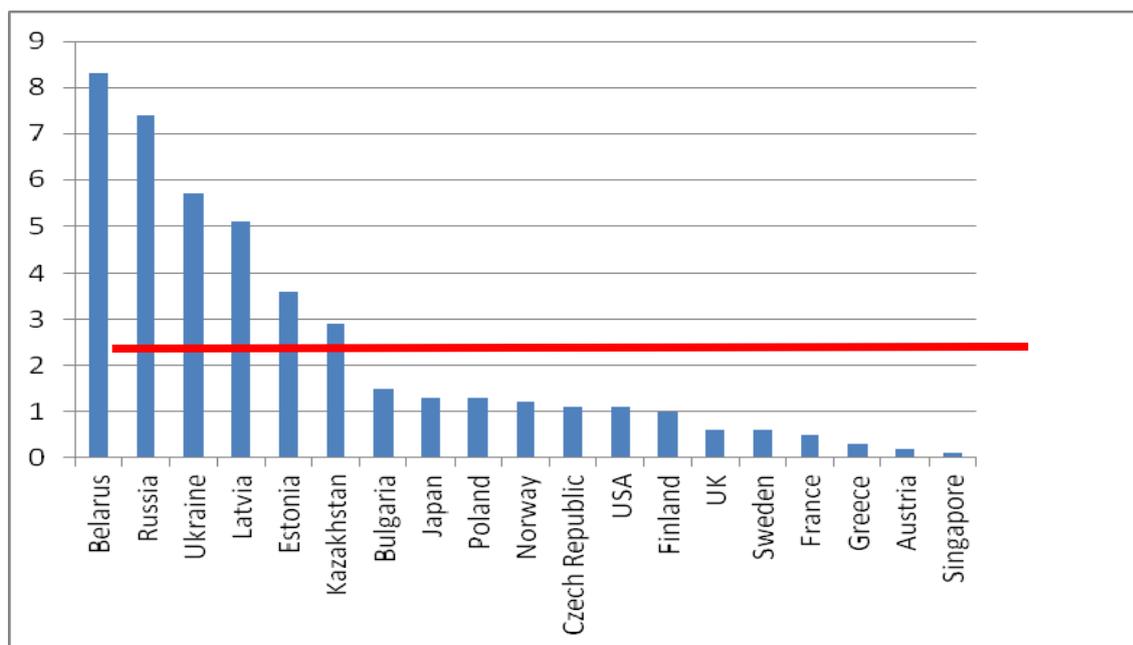
In order to conclude on the relevance and the need to develop models of integrated management of fire risks, a comparative analysis of the impact of the fires in Ukraine will be conducted, with the similar indicators of other countries.

The proportion of the number of deaths from fires per 100 thousand population in Ukraine is more than 2 times higher than the world average, which is 2.3 (Fig. 4).

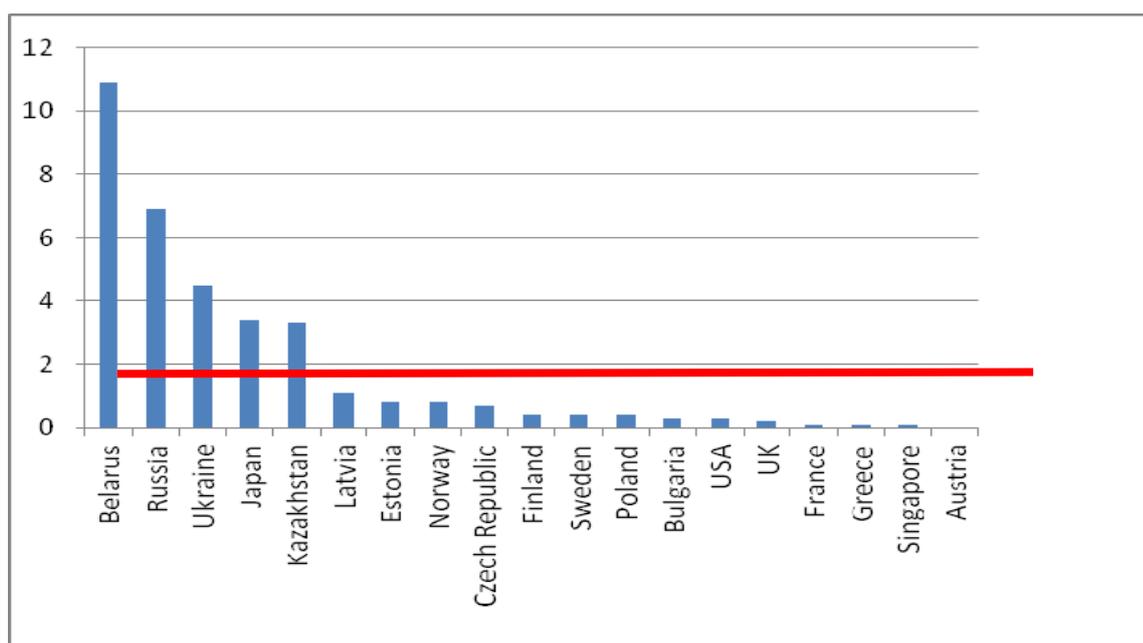
In Fig. 5 shows the average number of deaths per 100 fires for different countries of the world.

It is obvious that for Ukraine this indicator exceeds the world average more than twice, which is 1.9.

As for approaches to integrated fire risks management, the overall structure is given in figure [7]. However, there is currently no research regarding the substantiation of acceptable levels of risks taking into account existing socio-economic condition of our country and on the definition of "leverages" for reducing risks.



**Fig. 4. the Average number of deaths at 10<sup>5</sup> in 2014 year**



**Fig. 5. The Average death toll per 100 fires in 2014 year**

Thus, an actual and promising direction is the development of models of integrated fire risk management and their implementation at the regional level, taking into account the particularities of the respective administrative-territorial units of Ukraine.

**Conclusions.** In this work, the analysis of the main integral fire risks on the territory of Ukraine for 2013-2014 concluded that the greatest level of risk occurs on the territory of Zhytomyr, Kirovograd, Sumy and Chernihiv

regions, indicating the presence of problematic issues with respect to ensuring an acceptable level of fire safety. A comparative analysis of the impact of the fires in Ukraine was conducted with similar indicators in other countries. It is concluded that relevant indicators in Ukraine are more than twice higher than the world average, which indicates the need to develop models of integrated fire risks management.

Further research will be focused on the implementation of the classification of fire risks, identification of the main factors influencing the level of risks, development of methods for the determination of acceptable levels of integral fire risks and the management of these risks at the regional level.

## LITERATURE

1. The order of the Cabinet of Ministers of Ukraine dated 22.01.2014 No. 37-R "On approval of the Concept of risk management of emergency situations of technogenic and natural nature" [Electronic resource] // Access mode: <http://zakon4.rada.gov.ua/laws/show/37-2014-p>.

2. Sobol O. M. Problems in the implementation of the concept of risk management of emergency situations of anthropogenic and natural character / O.M. Sobol, A.V. Fedotov, I.Yu. Matveenکو // Problems of civil protection: management, prevention, rescue and special work: the collection of theses of the III all-Ukrainian scientific-practical conference (01-02 October 2015). – Kh.: NUCZU, 2015. – P. 37-38.

3. Terms and definitions of basic concepts: DSTU 2293-99. – [Valid from 2000.01.01]. – K.: State Standard Of Ukraine, 1999. – 22 p. – (national standard of Ukraine).

4. Ukrainian scientific-research Institute of civil protection, section (tab) analysis of array cards of the account of fires [Electronic resource] // Access mode: <http://www.undicz.mns.gov.ua/content/amkop.html>.

5. Kovalevich O.M. To the question about the definition of "risk" / Kovalevich O.M. – M.: VINITI, 2004. – P. 73-80 – (Problems of safety in emergency situations; rel. 1).

6. Brushlinsky N.N. On the concept of fire risk and related concepts / N.N. Brushlinsky, M.: FD VNIPO, 1999. – P. 83-85.

7. Brushlinsky N.N. Firefighters risks. Dynamics, management, forecasting / N.N. Brushlinsky. – M.: FD VNIPO, 2007. – 370 p.

8. Firefighters risks. Basic concepts / [brushlinsky N.N., Glucovance Y.M., Korobko V.B. the others]; edited by N.N. Brushlinsky. – [rel. 1]. – M.: VINITI, 2004. – 47 p.

9. State service of Ukraine for emergency situations [Electronic resource] // Access mode: [http://www.mns.gov.ua/content/national\\_lecture.html](http://www.mns.gov.ua/content/national_lecture.html).

---

С.Я. Кравців, О.Н. Соболев, А.В. Максимов

**Анализ интегральных пожарных рисков на территории Украины**

В данной работе проведен анализ основных интегральных пожарных рисков на территории Украины. Выявлены административно-территориальные единицы с высоким уровнем данных рисков, а также проведено сравнение удельных показателей последствий пожаров в Украине с аналогичными показателями для других стран. Отмечено, что дальнейшие исследования будут направлены на разработку моделей управления интегральными пожарными рисками с целью уменьшения количества и минимизации социально-экономических последствий пожаров.

**Ключевые слова:** интегральный пожарный риск, пожарная безопасность, управление рисками.

С.Я. Кравців, О.М. Соболев, А.В. Максимов

**Аналіз інтегральних пожежних ризиків на території України**

У даній роботі проведено аналіз основних інтегральних пожежних ризиків на території України. Виявлено адміністративно-територіальні одиниці з високим рівнем даних ризиків, а також проведено порівняння питомих показників наслідків пожеж в Україні з аналогічними показниками для інших країн. Зазначено, що подальші дослідження будуть спрямовані на розробку моделей управління інтегральними пожежними ризиками з метою зменшення кількості та мінімізації соціально-економічних наслідків пожеж.

**Ключові слова:** інтегральний пожежний ризик, пожежна безпека, управління ризиками.