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doi: <https://doi.org/10.31474/1999-981x-2020-1-148-157>**A.P. Bochkovkyi**  
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## DEVELOPMENT OF WAYS TO MINIMIZATION OF HUMAN FACTOR SIGNS IN OCCUPATIONAL HEALTH AND SAFETY

**Purpose.** Substantiation and development of ways to minimization of the "human factor" signs in occupational health and safety that relate to the low knowledge level of employees and employers in the field of occupational health and safety and motivation to comply with the requirements of normative legal acts in occupational health and safety.

**Methods.** Analysis of normative legal acts and scientific and technical literature, structural analysis of the causes of occupational accidents, probabilistic and statistical methods.

**Results.** Based on the analysis of statistical data concerning the causes of accidents in Ukraine (for 2007 - 2019 years), as well as normative legal acts concerning changes of training of specialists in occupational health and safety in higher educational institutions of Ukraine, it is established that for the period from 2010 to 2014 years (period of validity of the Order "On the organization and improvement of training in Occupational health and safety, Safety of vital activity and Civil Defence in higher educational institutions of Ukraine") the number of accidents that occurred for organizational reasons (which characterizes "human factor" signs) decreased by 17%. During the period of termination of the above order (from 2014), the corresponding indicator increased by 3% (while reducing the total number of workplaces by 10%).

It is established that the low motivation for increasing the level of occupational health and safety at the enterprises is attributable primarily to the inefficiency of the existing social insurance system in Ukraine, which is not based on the principles of determining the insurance premium rate relative to the existing level of risk of occupational dangers origin for workplaces. Accordingly, the main ways to minimization of the "human factor" signs in occupational health and safety are:

- obligatory training of future specialists of all, without exception, specialties in the cycle of disciplines in Occupational health and safety and Civil Defence within the set amount of hours and forms of control of the knowledge learning level;
- transition of the training system in occupational health and safety to the concept of development of qualitative and quantitative characteristics of training courses and materials on the basis of objective psychophysiological possibilities of learning of a certain amount of information by a person;
- development and implementation of the legal norm regarding the obligatory availability of basic higher education or scientific degree of teachers of the departments of occupational health and safety (scientific and pedagogical specialists) of the relevant specialty;
- transition of the social insurance system of Ukraine to the risk-oriented concept of differentiated approach to insurance premiums (based on the proposed mathematical model).

**Scientific novelty.** Ways to minimization of "human factor" signs in the field of occupational health and safety were substantiated and developed. A mathematical model to establish the relationship between the insurance premium rate of an enterprise to the Social Insurance Fund and the level of risk of occupational dangers origin is proposed.

**Practical importance.** Based on the research results, projects of changes to normative legal acts relating to the training system of occupational health and safety and the social insurance system will be proposed.

**Keywords:** occupational health and safety, "human factor", social insurance, occupational health and safety training, occupational dangers.

### Introduction.

The main purpose of functioning of modern occupational health and safety management systems at the enterprises is to prevent accidents, occupational diseases, as well as industrial accidents and catastrophes. To achieve this purpose it is necessary to clearly understand their causes and to develop and to implement activities and means for their elimination [1].

To date, official statistics in Ukraine consider three main types of causes of accidents - organizational, psychophysiological and technical [2, 3]. Organizational causes include non-compliance with requirements of occupational health and safety instructions, job

descriptions, technological process violations and others. Main psychophysiological ones include injuries or deaths as a result of unlawful actions of others persons, technical ones include unsatisfactory technical state of production units, buildings, structures, engineering communications, territory [2, 3]. Apparently, certain actions or inactivity of the person ("human factor" sign), therefore there was a certain accident combine these causes [4]. Although no statistics of the causes of other dangers (occupational diseases, as well as industrial accidents and catastrophes) is kept in Ukraine, however, the analysis of the results of their investigation shows that the cause is also certain "human factor" signs [4].

For example, an occupational disease can be both consequence of the employer's inaction concerning creating adequate working conditions and consequence of the employee's dereliction of requirements of the occupational health and safety instructions [5, 6]. And an industrial accident is also a consequence of relevant violations both by the employer, and by the employee [4].

Thus, in order to prevent of "human factors" signs, it is necessary to understand the causes that induce the employee (employer) to action or inactivity resulting in occupational danger. Despite the diverse nature of "human factor" signs, the common causes of their occurrence can be conditionally divided into three main groups. The first is related to the low level of work culture, the second is related to the low quality of normative legal support in the field of occupational health and safety, and the third is related to the psychophysiological reactions of the employee to the influence of the environment, as well as the processes occurring in his organism.

Taking into account complicated nature of the problem of minimization of the "human factor" signs in the field of occupational health and safety, in this study it is advisable to limit the development of ways to prevent causes related to the first group.

#### **Literature review.**

The following scientific works have been devoted to substantiating the urgency and development of ways of increase the work culture level in Ukraine [7 - 12].

In [7], the relationship between the level of occupational injuries and the implementation of progressive scientific and technological innovations, such as means of control the level of safety in the workplace, protecting employee from danger and harmful occupational factors, as well as occupational health and safety management systems, was investigated. The results of the research demonstrate that the implementation of such innovations while reduce the level of occupational injuries, but is ineffective without the appropriate level of work culture of employees. The work culture level, as well as the education of employees in the field of occupational health and safety according to the researchers are significantly higher in terms of occupational safety and needs considerable nation-wide attention.

In study [8], an analysis of the occupational safety situation in Ukraine created under the influence of modern dynamic processes was conducted, and the main problematic issues related to the reduction of the level of occupational safety culture due to the sharp increasing emergencies risk of natural, technogenic and socio-political origin were identified. The importance of safety disciplines as a necessary component of the modern educational process was emphasized and the ways to forming a new vision, system of ideals and values, that is, forming a holistic safety culture in professional training of the future specialist were proposed.

In work [9], a direct correlation between the professional education level, education in occupational health and safety and the qualitative and quantitative indicators of occupational diseases of employees of different industries and occupations was determined. It is shown that the level of employees' qualification, their education level in occupational health and safety plays a key role in level of individual and collective safety of employees.

In [10], the urgency of improving the occupational safety level of employees is considered and the importance of constant updating and development of knowledge in occupational health and safety and industrial safety as it depends on the degree of safety of employees is emphasized. According to the authors of the work, the solution to this problem is possible due to the transition to the concept of continuous education, in particular its main component - self-education. The conceptual basis of this education in the system of increasing the knowledge level in occupational safety, which should be included in all stages of professional development of employees (training, retraining, skills development, personal development, etc.), which will allow acquisition of new competencies and in general to increasing the general competence level is defined.

Researchers in [11] noted the negative trends concerning the exception Occupational Health and Safety, Fundamentals of Occupational Safety, Occupational Health and Safety in Speciality and Civil Defence to Bachelor's and Master's degree programs, as well as relevant sections to their graduation work. Although, based on the results of the analysis of the legal system of Ukraine

concerning obligatory teaching in the higher educational institutions of the above disciplines, the authors showed that it is unacceptable (violates the law of Ukraine), but these trends have taken place in Ukraine in recent years. The importance of providing the knowledge, practices and techniques of implementation of safe occupational activities for future specialists is emphasized in the work.

In study [12], which is devoted the impact of an employee's work mode on the their safety level in various industries, it is shown that one of the main factors of negative impact is an indicator - employee's knowledge level in occupational health and safety - that does not depend on the conditions and on the work schedule. In addition, another important factor of influence - job satisfaction (motivation), which is complex and includes the level of safety and comfort of the employee in the workplace, the level of their work culture, psycho-emotional climate in the team, economic factors, etc. - was underlined.

However, the analysis of these studies identified several **unsolved problems and defects**, which include the need to establish substantiated relationships between the employee's knowledge level in occupational health and safety and work culture, as well as to develop the ways to improve them, which will further prevent accidents, occupational diseases, and also industrial accidents and catastrophes that are caused by certain "human factor" signs.

#### **Purpose.**

The purpose of this work is substantiation and development ways to minimization of the "human factor" signs that relate to a low knowledge level of employees and employer in occupational health and safety and motivation to comply with the requirements of normative legal acts in occupational health and safety.

In order to achieve this purpose, following **tasks** have been set:

- to analyse the dynamics of changes in the number of accidents at Ukrainian enterprises in the context of specificities of reforming the higher education system;
- to identify the main problems of training specialists in occupational health and safety in higher education institutions of Ukraine;

- to develop ways of minimization the "human factor" signs in the field of occupational health and safety.

#### **Methods.**

Analysis of normative legal acts and scientific and technical literature, structural analysis of the causes of occupational accidents, probabilistic and statistical methods have been used.

#### **Presentation of main material.**

The problem of minimization of the "human factor" signs in the context of increasing the work culture level should be considered from the perspective of three main aspects related to the formation of the necessary knowledge level in occupational health and safety of employee (employer), motivation (both employee and employer) to comply with the requirements of relevant normative legal acts, as well as ensuring the functioning of an effective system of control over compliance with occupational health and safety rules and regulations.

At the same time, the necessary knowledge level is not simply as "attending" certain training course in an educational institution by future specialist (training program in the appropriate educational and methodological centres by employee or by employer), but as formation the mindset of the principle of "priority of their own and collective safety" in the conditions production activities. In particular, this is necessary taking into account the need to implement the third article of the Constitution of Ukraine "A person, his life and health, honour and dignity, integrity and safety are recognized in Ukraine as the highest social value".

Motivation should be understood as implementation of a system of financial rewards and sanctions for employees at enterprises, as well as the creation and maintenance of a progressive, risk-based social protection system for employees at the state level.

Effective control system means the following three-tier system. At the first level, control is conducted by the employee through self-monitoring of conformity of working conditions in the workplace with the requirements of normative legal acts and through compliance with the requirements of occupational health and safety instructions. At the second level, appropriate control is

conducted for each workplace by the employers at the enterprise. And finally, at the third level, the overall control over occupational health and safety is conducted by state control authorities. In this case, there is a direct correlation between the motivation of the employee and the employer to comply with the requirements of normative legal acts in occupational health and safety and the effectiveness of the control system over occupational health and safety at the enterprise at the first two levels.

An important step towards forming of the principle of "priority of safety" by future specialists is the general Order of the Ministry of Education and Science of Ukraine, the Ministry of Emergency Situations, as well as the Derzhgirpromnaglyad of Ukraine "On the organization and improvement of training in Occupational health and safety, Safety of vital activity and Civil Defence in higher education institutions of Ukraine". According to the Order, a list of obligatory disciplines for all students (regardless of specialty and form of education) in the field of Safety of vital activity, Occupational health and safety and Civil Defence in emergency situations was established for higher education institutions. For these disciplines, a minimum amount of hours for training, as well as forms of knowledge control as an exams and differential credits were set. Typical training programmes for the respective disciplines were also introduced for the implementation of this Order. The main positive aspect of such means is the implementation of the so-called "principle of a guaranteed programme of training of specialists in occupational health and safety". That is, any higher education institution guarantee provides a certain "basic" training level in occupational health and safety by young specialist for employer [4, 13].

However, the positive effect of the implementation of the requirements of the Order was decrease slightly due to practical absence of a legal basis for motivating employees and employers at enterprises to comply with the rules and regulations in occupational health and safety in the workplace. Well, although the rewards and sanctions system for employees took place at some enterprises, its effectiveness was questionable since it depended only on the employer's mind, but not on the motivation to create the adequate working conditions. The above motivation by the state was limited to the employer's

responsibility for the detected violation during inspections by the supervisory authorities or in case of an accident. However, the relatively small amount of sanctions for certain violations and the existing problem of "informal agreement" in case of violations significantly reduced and reduce the effectiveness of the motivation.

However, despite these problems, the analysis of statistical data from 2011 to 2014 (period of termination of the Order and moratorium on inspections of enterprises by the supervisory authorities, inter alia, in occupational health and safety) shows positive dynamics of decreasing the number of accidents due to organizational causes (characterizing precisely the work culture level) by almost 17% (Fig. 1) [2 - 4]. Upon analysis of relevant data for the previous years (before the enactment of the Order), there is dynamics of the increase in the number of accidents by 3% (from 2007 to 2011), as well as a sharp decrease of ones (after the enactment of the Order) from 2011 to 2012 by 10% (Fig. 1) [2- 4]. The last rate, as well as the positive trend of 2011-2014, while indirectly, proves the effectiveness of implementing appropriate changes in the education system.

Although, in 2014 with the adoption of the Law of Ukraine "On Higher Education" (according to which the standard programmes for the respective disciplines were eliminated), the Order was revoked, and, in addition, a moratorium on inspections of enterprises, in particular by state supervisory authorities in occupational health and safety was introduced (it remained in force until 2018).

Upon analysis of relevant statistics data for this period (namely from 2014 to 2019), it can be concluded that despite the decrease in the number of registered jobs (more than 10%), the number of registered accidents due to organizational causes increased by 3% (Fig. 1) [2 - 4]. At the same time, there is a steady tendency of gradual increase in accidents in the structure of organizational causes, which are related to non-compliance with the instructions in occupational health and safety (by almost 6% in the last three years only (Fig. 1)). This demonstrates the increase in the negligence of requirements in occupational health and safety by employees and employers. It is noteworthy that relevant indicator for Ukrainian enterprises decreased by 10% from 2011 to 2014 (Fig. 1) [2 - 4].

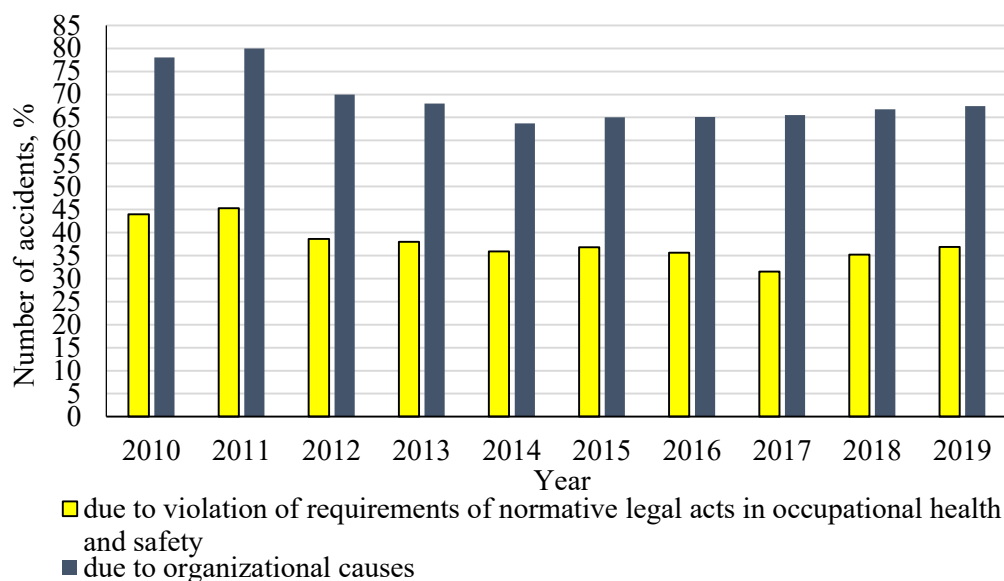


Fig. 1. Dynamics of change in the number of accidents in Ukraine by years

Thus, based on the results of the analysis of statistical data and considering despite the lifting of the moratorium on inspections, the dynamics of the number of accidents due to organizational causes is negative, it can be concluded that the need for introducing positive changes in the training system of specialists in occupational health and safety, and developing effective means to motivate employers and employees to clearly comply with the requirements of normative legal acts in occupational health and safety.

To date, according to the Law “On Higher Education”, higher education institutions of Ukraine independently set the nomenclature and volume of educational disciplines in particular in occupational health and safety, based on the standards of higher education. These standards are developed by the Scientific and Methodological Council of the Ministry of Education and Science of Ukraine for each specialty and are approved by the National Agency for Quality Assurance in Higher Education. Particularly, the standards determine the volume of ECTS credits (total hours of training of disciplines), the list of required competencies of the graduate, the form of students certification and more. In this case, the current educational training of future specialists in occupational health and safety is characterized by the following *main* problems.

The *first* of these is that among the 31 competencies recommended for education standards, only one (formally) relates to the

field of occupational safety and health - “performing safe activities” [14]. As shown, the general nature of this competence is background to set nomenclature of the respective disciplines by higher education institutions at will. In practice, that results in offer training variety of disciplines combined in a single unit such as Civil Defence and Occupational Health and Safety in Speciality, Safety of vital activity and Fundamentals of Occupational Safety by students. The purpose of this is to redistribute training hours (within volume defined by Ministry of Education and Science) - increasing hours of certain, usually graduating, departments through decreasing hours of Safety departments of higher education institutions. For the same purpose, such control forms of knowledge acquisition for the relevant disciplines as ordinary credits instead of exams or differentiated credits (for which more careful study of course material is required) are set. That state of affairs leads to a formalization of the study of disciplines, which is reflected in knowledge level of the future specialist in occupational health and safety and negligible in these issues in the further (as demonstrated by the above statistics).

In addition, recently there is a tendency to the transition of occupational health and safety disciplines to selected category in certain higher education institutions of Ukraine. Against existing negligible in these disciplines, this can lead to their loss from the training programs of future specialists. In turn, sector of

the national economy receive specialists uninformed how to provide their own and collective safety within the production processes. The consequence of this will necessarily be increase in the number of accidents, occupational diseases, and industrial accidents and catastrophes.

The *second* problem is that most education standards do not contain any occupational health and safety and safety of vital activity competencies. In this case, there is the issue of impossibility to provide own and collective safety in the production conditions without having even the basis knowledge in the field. Considering specialists with higher education are the employer's personnel reserve of the country, there is the issue of impossibility to comply with requirements of the Law of Ukraine "On Occupational Health and Safety", in particular to ensure comfortable, healthy and safe working conditions. There is the issue of impossibility training, for example, Fire Safety in schools due to study in occupational safety and health of future teachers was perfunctory. Thus tendency to increasing the number of deaths caused by fires in schools should not be surprising. Unfortunately, these issues remain open, and the above statistics (regarding the growing number of accidents due to organizational causes) confirm their urgency and seriousness.

The *third* problem is that to date for some specialties there are no education standards (about 50% in total). Thus, the above problems are urgency for them too.

Based on the identified problems of the training system of future specialists in occupational health and safety in higher education institutions of Ukraine, the following ways of their solution can be proposed, which in turn will allow increasing the work culture level at the enterprises in the further.

The first of these is the need for a renewal of the Order, which will allow specifying the competency requirements of "safe activity" for education standards on the principle "from general to specific" [4]. The second way is to improve the quality of learning and teaching occupational safety disciplines. And finally, the third way is to immediately ensure for all, without exception, specialties by educational standards that will take into account the requirements of the Order.

The problem of increasing the level of motivation of employees and employers at

enterprises to comply with the requirements in occupational health and safety is also very complicated, and its solution implied change in the concept of social insurance in Ukraine primarily. Namely, the transition of the system of social insurance against accidents and occupational diseases at enterprises from the existing concept of a unified social premium to the concept of a differentiated approach to such premium depending on the level of risk of occupational danger origin for each workplace. That is, the more dangerous the enterprise is and the more dangerous or harmful the working conditions are for each workplace, the greater the contributions to the Social Insurance Fund (hereinafter the Fund) by the enterprise should be. This concept is progressive and exists in many countries, including the EU.

#### **Discussion of results.**

The analysis of the statistics concerning the structure of the causes of accidents identified the need to change the existing system of training specialists in occupational health and safety, as well as to change the existing system of motivation of employers at enterprises to create safe, healthy and comfortable working conditions.

The above education system is characterized by the following three problems: the general nature of existing and unified competence in education standards for safe activities, the absence that competence in 70% of the education standards, and the lack of education standards for almost 50% of higher education applicants.

The solution to these problems involves the development of means for the renewal of the Order for the obligatory and consistent training of the cycle of disciplines "Safety of Vital Activity" - "Fundamentals of Occupational Safety" - "Occupational Health and Safety in Speciality". It should be noted that the list of these disciplines is given only as an example procedure for training future specialists and needs to be revised and supplemented in accordance with the existing Concept of reforming the management system of occupational health and safety in Ukraine. This involves, in particular, the development of new standard programmes aimed at acquiring competencies concerning occupational health and safety management by students through a proactive approach (forecasting and preventing occupational dangers origin).

The next step is improving the quality of learning, which, in turn, involves the development of a science-based approach to setting the amount of hours to study a certain volume of training material. Notably, to date (as in the past) setting the amount of hours to have occupational health and safety knowledge is carried out except subjectively. For example, according to the Order for studying the respective disciplines, the amount of training hours no less than 54 hours was determined. And, according to the requirements of NPAOP 0.00-4.12-05, for studying theoretical part occupational health and safety, only 30 hours were determined. At the same time, for retraining and skills development of employees, no less than 15 hours were determined. The theoretical part "Occupational Health and Safety" during training of specialists for jobs that do not belong to the list of high-risk jobs, no less than 15 hours were determined, but during retraining and skills development, no less than 8 hours were determined [4]. It is obvious that the existing subjective approach to setting the volume of training hours is formal and needs revising. In this case, the solution to this problem is setting objective relationships between the qualitative characteristics of the educational material and the psycho-physiological possibility of a person to learning material over time. This is a complicated problem that requires the development of certain mathematical models based on the provisions of known psycho-physiological laws (Weber-Fechner and others) [4]. Equally important is the problem of improving the quality of training occupational health and safety disciplines. It is known that academic staff of the profile departments of many higher education institutions in Ukraine do not belong to specialists in occupational health and safety by their qualifications (on educational or scientific specialty). In this case, MES and higher educational institutions management should set clear criteria concerning conformity with teacher's profile of the department and the disciplines they teach because the existing conformity of the teacher's qualification and types and results of professional activity (according to the "Licensed Terms of Educational Activity") cannot be considered as objective. It is a proven because none of the paragraphs firstly does not provide for teacher's special education in occupational health and safety or a degree in the relevant specialty, and

secondly does not contain conditions conformity with subject matter of teacher's factual scientific works and the department profile [15]. Conformity of the specialty of teachers of the department's profile is obligatory for improving the quality of education in occupational health and safety and also in other disciplines.

The main problem of implementation of the concept of differential social insurance premiums and the effectiveness of its premium (to increase motivation for creating safe and healthy working conditions at the enterprise) is the lack of mathematical models that allow setting objective relationships between the occupational risk level and the amount of insurance premium. To set these relationships, it is possible to suggest application of the optimized mathematical model developed by the author, which allows considering the case of health injury of an employee by the combined and separate influence of negative production factors, which was tested in the Fund [4, 16]:

$$\sum_{i=1}^n [H_i + p_i g_i (h_i + H_i)^{-j_i}] \leq \Phi, \quad (1)$$

where  $H_i$  – resources to minimize the impact of  $n$  types of negative production factors,  $p_i$  – the cost of eliminating one unit of consequences of the implementation of occupational risk in danger,  $\Phi$  – the amount of financial resources of employer for employee's occupational health and safety during the time  $T$ ,  $g_i$ ,  $j_i$  – data that are determined by processing statistics concerning actual exceedances of the maximum permissible concentrations (levels) at the relevant costs allocated to protective means.

In this case it is necessary to compare the value  $\sum_{i=1}^n k_i g_i (h_i + H_i)^{-j_i}$ , which can be obtained as a result of solution (1) with the amount of the insurance premium, where  $k_i$  – the value of the maximum permissible concentration (level) of  $i$  negative factor.

### Conclusions.

1. Based on the analysis of statistical data concerning the causes of accidents in Ukraine (for 2007 - 2019 years), as well as normative legal acts concerning changes of training of specialists in occupational health and safety in higher educational institutions of Ukraine, it is established that for the period from 2010 to 2014 years (period of validity of the Order) the number of accidents that occurred for

organizational reasons (which characterizes "human factor" signs) decreased by 17%. During the period of termination of the above Order (2014 - 2019), the corresponding indicator increased by 3% (while reducing the total number of workplaces by 10%) indicating the inefficiency of the modern training system of specialists in occupational health and safety and the need to develop means for its reform and to increase the motivation of employees and employers at enterprises to compliance with requirements of normative legal acts in occupational health and safety.

2. The main problems of training of specialists in the field of occupational health and safety in higher educational institutions are the uncertainty and non-substantiation the characteristic and essence of competence in Civil Defence (in particular in occupational health and safety) in the existing education standards, non-requirement of having such competence by students of most specialties (administrative, medical, ecological, information and others, in general about 70% of specialties), as well as the practical absence of these standards for nearly 50% of specialties.

3. The main ways to minimization of "human factor signs" in the field of occupational health and safety are:

- renewal of the Order for the obligatory training of future specialists of all, without exception, specialties in the cycle of disciplines in occupational health and safety within the set amount of hours and forms of control of the knowledge learning level;

- transition of the training system in occupational health and safety to the concept of development of qualitative and quantitative characteristics of training courses and materials on the basis of objective psychophysiological possibilities of learning of a certain amount of information by a person;

- development and implementation of the legal norm regarding the obligatory availability of basic higher education or scientific degree of teachers of the departments of occupational health and safety (scientific and pedagogical specialists) of the relevant specialty;

- transition of the social insurance system of Ukraine to the risk-oriented concept of differentiated approach to insurance premiums to the Social Insurance Fund of Ukraine (based on the proposed mathematical model).

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### РОЗРОБКА ШЛЯХІВ МІНІМІЗАЦІЇ ПРОЯВІВ «ЛЮДСЬКОГО ФАКТОРА» В СФЕРІ ОХОРОНИ ПРАЦІ

**Мета.** Обґрунтувати та розробити шляхи мінімізації проявів «людського фактора», що пов'язані з низьким рівнем знань працівників та керівників підприємств в сфері охорони праці, а також низьким рівнем мотивації до виконання вимог нормативно-правових актів з охорони праці.

**Методи.** Аналіз нормативно-правових документів та науково-технічної літератури, структурний аналіз причин виникнення нещасних випадків на виробництві, ймовірно-статистичні методи.

**Результати.** За результатами аналізу статистичних даних щодо причин виникнення нещасних випадків в Україні (за 2007 – 2019 роки), а також нормативно-правових актів, які стосуються змін порядку навчання спеціалістів з питань охорони праці в навчальних закладах України встановлено, що за період з 2010 по 2014 роки (період дії Наказу «Про організацію та вдосконалення навчання з питань охорони праці, безпеки життєдіяльності та цивільного захисту у вищих навчальних закладах України»), кількість нещасних випадків за організаційними причинами (характеризують прояви «людського фактора»), скоротилась на 17%. За період припинення дії зазначеного Наказу (з 2014 року) відповідний показник збільшився на 3% (при скороченні загального числа робочих місць на 10%)

Встановлено, що низька мотивація до підвищення рівня охорони праці на підприємствах обумовлена, в першу чергу, неефективністю існуючої системи соціального страхування в Україні, яка не ґрунтується на принципах визначення розмірів страхових внесків відносно існуючого рівня ризику виникнення професійних небезпек для робочих місць. Відповідно, основними шляхами мінімізації проявів «людського фактору» в сфері охорони праці є:

- обов'язкове вивчення майбутніми спеціалістами всіх, без виключення, спеціальностей підготовки циклу дисциплін з охорони праці та цивільної безпеки в рамках встановленого обсягу годин та форм контролю рівня засвоєння знань;

- перехід системи навчання з питань охорони праці до концепції розробки якісних та кількісних характеристик навчальних курсів і матеріалів, виходячи з об'єктивних психофізіологічних можливостей засвоєння людиною певного об'єму інформації;

- розробка та впровадження правової норми щодо обов'язкової наявності у викладацького складу кафедр охорони праці базової вищої освіти або наукового ступеню з відповідної спеціальності;

- перехід системи страхування України до ризик-орієнтованої концепції диференційованого підходу сплати страхових внесків (на основі запропонованої математичної моделі).

**Наукова новизна.** Обґрунтовано та розроблено шляхи мінімізації проявів «людського фактора» в сфері охорони праці. Запропоновано математичну модель для встановлення залежностей між розміром страхового внеску підприємства до Фонду соціального страхування та рівнем ризику виникнення професійних небезпек.

**Практична значимість.** За результатами досліджень будуть запропоновані проекти змін до нормативно-правових актів, що стосуються системи навчання з питань охорони праці, а також системи соціального страхування.

**Ключові слова:** охорона праці, «людський фактор», соціальне страхування, навчання з охорони праці, професійні небезпеки.

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