INNOVATIVE SECURITY TECHNOLOGIES IN THE MANAGEMENT OF BUSINESS FACILITIES

Kurepin Viacheslav *Candidate of Economic Sciences, docent, associate professor of the department of professional training methods Mykolaiv National Agrarian University*
kypins@ukr.net

Анотація. Довоєнні часи охорона праці була досить консервативною галуззю, щоб вирішити безпекові питання потрібно було витратити достатньо зусиль та часу, а виділення коштів на охорону праці, безпеку та гігієну вважалося щось екстравагантним. Але останні роки, воєнні роки для України, виникає потреба у її розвитку. На благо безпеки деякі технології, зокрема інноваційні, не тільки здатні працювати, вони вкрай необхідні для забезпечення безпеки на виробництві [1].

Ключові слова: консервативна галузь, забезпечення безпеки, керівники об'єктів, інноваційні заходи, безпекові технології.

Abstract. In pre-war times, occupational health and safety was a rather conservative industry, so that sufficient effort and time had to be spent to solve safety issues, and the allocation of funds for occupational health, safety and hygiene was considered somewhat extravagant. But in recent years, the war years for Ukraine, there is a need for its development. For the sake of safety, some technologies, in particular innovative ones, are not only able to work, they are absolutely necessary to ensure safety in production.

Keywords: conservative industry, security, facility managers, innovative measures, security technologies.

Formulation of the problem. The creation of modern, innovative computerized occupational health and safety management systems maximizes the effectiveness of the occupational health and safety management system of business facilities, including the production level. The state national concept of the development of the field of labor protection management requires an immediate solution to the problems of safety and hygiene at work.

The use of safety technologies at the workplace or modern technologies in labor protection will allow to maximally reduce the influence of the so-called «human factor» on decision-making in the existing labor protection management systems. This will certainly lead to a reduction in production risks [2].

The use of a risk-oriented approach, which consists of two elements: risk assessment (analysis of the occurrence and scale of risk in a specific situation); risk management (analysis of the situation and development of solutions aimed at reducing the risk to an acceptable minimum)

makes it possible to ensure maximum efficiency and the maximum possible optimization of decision-making in complex security situations. Computerized occupational health and safety management systems should help with this.

Taking into account the fact that the complex system approach is established at the legislative level and covers the spectrum of preventive safety measures, it is necessary to provide for the introduction of innovative solutions and processes in the production activities of economic facilities.

Effective business development is impossible without modernization of measures, without ensuring safe working conditions at economic facilities. The working population cannot feel safe without the most important elements of the state's social policy. No enterprise will be able to develop without compliance with labor protection laws in its production. In such conditions, in order to reduce industrial injuries and occupational diseases, modern innovative technologies in labor protection should help both managers of economic facilities and labor protection specialists. Therefore, an important direction in the research of scientists and specialists in industrial safety is the development of methods of reduction and ways of preventing accidents and injuries in industrial conditions by using safety technologies at the workplace or modern technologies in labor protection.

Analysis of recent research and publications. The relevance of the topic of research on the use of safety technologies at the workplace or modern technologies in labor protection is related to the development and improvement of safety conditions at work. About that, the scientific community, practitioners have not yet come to a unity of concepts regarding the management of innovative activities of enterprises in matters of occupational safety and hygiene organization at workplaces and the enterprise as a whole.

Scientific publications of leading researchers contain definitions of problems, concepts and methods of evaluating the innovative activity of enterprises, which would contribute to the creation and maintenance of proper, safe, healthy working conditions. The problems of innovation in various spheres of activity, in particular in the field of labor protection, were revealed in their works by such scientists as A.M. Bezus, S.A. Bondarenko, S.I. Fedulova, N.V. Yashkina, D.O. Spring.

Formation of goal. On the basis of a review of literary sources, consider the theoretical and methodological principles of safety management at economic facilities on the basis of sustainable development using innovative technologies. To determine the conditions for carrying out innovative activities of economic entities on the use of safety technologies at workplaces or modern technologies in labor protection, which are related to the development and improvement of safety conditions at work.

Presenting main material. High interactive technologies are rapidly developing in all sectors of the economy, including the security sector. We are not surprised by the appearance of new technological tools that help improve working conditions in production [3].

VR glasses, one-click signing of documents, remote medical examinations (especially after the pandemic), video surveillance systems no longer surprise either the heads of enterprises (employers), nor employees and occupational safety specialists. Such words as automation, digitalization, gamification, and innovation have entered the production space. Experts believe that such innovations in labor protection should be implemented today. But in many cases, when solving issues of the development of modern technologies in security matters, they remain just the topics of speeches at official meetings and industry events.

Since a dozen years ago, managers of economic facilities were quite skeptical about the introduction of high-tech devices in the field of occupational health and safety [4]. They considered it inappropriate to entrust human life to machines. They considered such ideas dubious and preferred traditional, proven technologies that would give a stable result. But only breakthrough technical and organizational developments, which are considered innovations, can truly provide a stable result. But only breakthrough technical and organizational developments, which are considered innovations, can truly provide a stable result. It is precisely such innovations that must be successfully used at economic facilities, in particular to ensure occupational safety and hygiene.

Gradually, innovations in the field of labor protection, which will bring new technologies to the safety of individual workplaces and works, as well as the enterprise as a whole, are increasingly included in the professional activity of employees of economic facilities. But you should be prepared for this, because innovations and new technologies, unfortunately, create professional risks. They are related to their use, which increases the workload on employees and creates stressful situations.

Business leaders (employers) must have an idea of the real cost of workplace safety. They should worry about ensuring the safety of employees, be prepared for medical expenses. This should be the number one priority for employers. But there is another side, which is the loss of reputation and holding employees to court costs in connection with failure to fulfill their duties regarding the organization of safety at work.

Loss of reputation is undesirable for employers, so they should invest more in the safety of their employees without risking serious financial losses. Unfortunately, there is a high risk of workplace injuries in Ukraine in many sectors of the economy. Industry and manufacturing are inherently risky environments. But employers always want to attract and retain the best employees who are able to solve various tasks with high quality. They try to avoid any fines and costs, take

into account the true value of a safe workforce. In such matters as creating better working conditions, the latest innovative solutions can help.

Domestic and foreign manufacturers offer employers various innovative solutions in the fields of IT, visual management, automatic monitoring of the employee's condition, new formats of education and training, etc. Such innovations are the future, they are gradually included in the activities of economic entities [5].

Under the conditions of the introduction of innovative technologies in safety, labor protection specialists are increasingly becoming a cross-functional employee. He needs knowledge of legislation and regulations, which, by the way, are becoming broader and stricter every year, to have communication skills, leadership qualities. They must have the skills to customize employee training.

On the one hand, this is an expansion of competencies aimed at increasing the level of safety culture at business facilities and reducing industrial injuries at workplaces. On the other hand, this is an additional burden on one person (all these functions are performed by a single specialist), and on top of the main duties. We consider such a situation as an additional risk factor in which it is easy to make a mistake (not to follow employees or simply not have time to prepare some important documents, etc).

There is another situation that occurs in small and medium-sized enterprises, when there is no such specialist at all. And this happens quite often. Analyzing literary sources, we considered the theoretical and methodological principles of managing the security of business facilities using innovative highly interactive technologies, determined the conditions for conducting innovative activities of business facilities on the use of security technologies at workplaces and enterprises in general.

In order to improve safety conditions at work using modern technologies in labor protection, we offer tools for automating and increasing the efficiency of labor protection, which can be used at business facilities. These innovations will help reduce injuries at the enterprise [6], the number of violations, and free up time for labor protection service specialists by eliminating the loss of working time to work with employees who violate safety and occupational hygiene rules.

Let's consider classic technologies for labor protection at business facilities:

1. Innovative protective materials. The following are widely distributed and are already in use at some enterprises: protective shoes with an innovative composite material under the toe; uniform; special masks and half-masks with different filters, inhalation and exhalation valves; shields of electric welders are equipped with removable high-tech light filters, etc. The development and production of protective materials allows: to reduce/remove the pressure of the foot on the upper edge of the shoe, which prevents fatigue of the worker's legs, and most importantly - prevents

damage to the foot in the event of an impact (shoes), the convenience of movement is created thanks to the appearance of special sneakers with identical protective properties of shoes; reliably protect workers who work in conditions of exposure to dangerous harmful factors of the production environment from most harmful production factors (special clothing made of innovative polyester material); to 100% protect workers involved in fire-hazardous work [7] from harmful thermal radiation and splashes of molten metal, while not distorting visibility (shields of electric welders with removable high-tech light filters).

2. Anchor systems. Innovative fall protection solutions include vertical and horizontal anchor systems. With the help of such systems, workers perform the most difficult and dangerous work with a sense of confidence and security. They are convenient and economical, taking into account the costs of working time, they have a long service life. New locking devices are gradually replacing simple safety slings. They are convenient, the principle of their operation resembles the seat belts in a car. If the slings are gradually pulled out, the device is extended, and in case of a sudden fall, the device is blocked.

Note that similar products are individual protection, although improved, but also common. New technologies for workplace safety are only included in the lists of labor protection [8]. These include cameras and sensors for automatic safety control; reasonable means of personal protection; gamification in education; visual control; programs and services for recording violations, etc. Next, we will consider new technologies:

1. Video recording. A fairly common way of ensuring safety in the premises and on the territory of business facilities is to monitor compliance with occupational safety and health legislation with the help of video surveillance. In labor protection, video surveillance is used to establish violations of labor protection requirements in the event of an accident, to clarify the circumstances and situation online and in video recording mode.

Video surveillance allows: to detect dangerous behavior of the company's personnel during the performance of their official duties; automate processes in which employees participate; ensure the safety of the workplace and the environment; automatically record the absence of personal protective equipment and other violations. Video surveillance systems work both hardware and software interacting with sensors. Such systems can view and analyze video recording, take still images of violations and report them immediately.

GPS-tracking (satellite tracking) allows you to warn personnel about entering dangerous areas. Mobile GPS trackers are already used by supervisors of high-security works, which notify both the employee of approaching a dangerous zone and the supervisor himself of violations of safety requirements by his subordinates.

At business facilities with an advanced attitude to occupational health and safety, workplace safety is in many cases ensured by sensors for presence and changes in the environment, security light and sound detectors. Signal detectors are also used, which inform about the employee who neglected the means of protection. This allows you to react early and take measures to eliminate violations.

2. Control of access to the work area. Unfortunately, there are occupational risks [9] in the production areas of enterprises, for example, the probability of an employee passing through a protective fence into the area of moving and rotating mechanisms. Such violations lead to accidents, injuries, and fatal events. To prevent such cases, perimeter security and audio-visual signaling systems are used. They can be combined with smart video surveillance or with infrared sensors. These systems dissuade workers from entering the danger zone, sound an alarm, interrupt the power supply circuit or close the emergency button of the equipment, and it stops.

3. Clothing and personal protective equipment. When using special clothes, the employee sometimes does not change them after a certain period of time (forgetting, unwillingness to spend time on changing, etc). Special sensors, determining the degree of wear of protective equipment, inform a person about the need to change clothes. These are innovative technologies in personal protective equipment. «Smart» helmets have sensors that record the wearer's heart rate and temperature. Personal protective equipment is equipped with a system of pressure and volume sensors, GPS, gyroscope, accelerometer, Bluetooth and GSM modules. Such a helmet «feels» a person (overheating of a person, a fall has occurred). It reads and transmits information about the location of the employee, his activity and well-being to the control point, vibrates and emits a warning sound. Some helmets have video cameras, equipped with AR glasses. Collected information is stored in the cloud and analyzed to identify potential risks.

4. Augmented reality (AR). Virtual reality technologies help to move away from the limit of analog reality, such technologies transfer us to the digital plane, we mention Virtual Reality (VR). The use of VR helps to widely implement gamification solutions, develop models of production facilities and remote tours of business facilities. But VR clearly divides the world into two halves - real and virtual, preventing one from penetrating the other.

Augmented Reality (AR) with its devices allows breaking this barrier: special glasses, smartphones, tablets, stationary screens, helmets and projection devices. Using special programs, digital information, text, images, etc. are projected onto the screen of one of them. With the help of AR-glasses, remote control of work is carried out. The device broadcasts the surrounding environment to a remote expert from anywhere in the world, who can provide advice, suggest safety measures, etc without being present at the scene of the event. Also, with the help of augmented reality, you can learn about some technological parameters of the process.

AR-technologies directly and indirectly affect labor safety, allow to build the boundaries of dangerous zones, promptly notifying a person about their crossing; conduct training at the workplace using a remote assistant (conduct training at the workplace using a remote assistant (video courses); when training to simulate potentially dangerous conditions that would be too risky or expensive in a real production process; conduct remote inspection of dangerous works, etc.

5. Intelligent special shoes. Currently, smart boots are available for use, which have built-in sensors that determine the state of the worker (a person has fallen or been hit) and immediately report the location of a potential victim.

6. Exoskeletons. They are used to relieve the muscular skeleton of a person. This is a very promising know-how in the world of occupational safety, they improve posture and prevent injuries by fixing the back, legs or arms. They have varieties: some reduce the level of load, others support the legs. They are used by workers who are forced to lift something and hold their hands up or squat with tense legs all day long. Exosuits are promising intelligent means of personal protection.

7. Gamification in education. A game on a computer or phone that prompts an employee to perform safety tasks. Such simulations suggest identifying potentially dangerous works, zones, places, objects; check your knowledge of occupational health and safety, civil protection, etc.

8. Augmented and virtual reality. We understand that not everyone likes AR and VR technology, in particular employees with very long work experience, but we need to involve those who work to learn through augmented AR and virtual VR. The difference between them is that AR requires some kind of device, such as a tablet or phone, while VR requires special glasses. The future employee, with the help of technology, finds himself at the workplace and safely practices various potentially dangerous situations and high-security work. With their help, the future employee feels the presence on the production site or workplace, helps to better learn the location of premises, equipment, objects. A job applicant not only studies the material and a detailed description of all workplace processes, but also immediately sees how everything functions and looks «live» [10].

9. Visual control. An opportunity to improve working conditions and accident prevention due to an innovative method based on the principles of lean production. Includes: designation of dangerous zones, application of visual markings on the floor; light indication; color designation of acceptable operating parameters of measuring devices, etc.

10. Programs and services for recording violations. Special services that will help download photos and videos from the phone and immediately send it for inspection, providing the necessary consultation, etc. Each employee can take a photo/take a video of a violation of labor safety rules and send it to the platform, the information will be read by the manager, who will be able to establish the circumstances of the danger and immediately apply preventive measures. This

innovative method helps to involve the entire team of the business object in monitoring compliance with labor protection rules, increases the level of responsibility of all participants in the production process of the enterprise, and also simplifies communication between the labor protection service and employees.

Conclusions and prospects for further scientific research. The use of safety technologies at the workplace or modern technologies in labor protection have recently gained intensity. With the help of organizational innovation solutions (innovations in labor protection), personnel training systems for knowledge of labor protection norms and rules are being improved. For this, training and computer technologies are used, remote monitoring of technological processes is introduced, personnel are provided with tracking devices and personal protective equipment. The task of the labor protection service of the enterprise is to minimize the probability of accidents and uncertain situations, while simultaneously ensuring conditions for maximum labor productivity. However, it is impossible to cope with such tasks without the use of safety technologies at the workplace or modern technologies in labor protection.

The concept of innovation in the modern conditions of business activity should be considered from a new angle, the angle of qualitative changes that lead to activity and dynamic development, carry significant positive factors in the development of the enterprise. Innovative security and its provision is considered as an integral part of the security system of the enterprise, it is connected with the process of transforming a productive idea into a practical plane, which should be studied and researched in more detail. The issue of using, implementing, and achieving the effectiveness of the occupational health and safety management system has always excited research scientists to new developments, analytical conclusions, and discussions.

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