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On the Choice of Personal Protective Equipment Taking into Account the Occupational Risk

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Abstract. *The article contains recommendations on modernization of the methodology of provision of personal protective equipment based on a risk-based approach in the Republic of Kazakhstan. The experience of providing personal protective equipment using the United States as examples is presented. The Russian experience in providing PPE is analyzed and typical features of their issuance are highlighted. The procedure for providing PPE is given, taking into account the assessment of occupational risk. An algorithm for providing PPE according to the new nomenclature is proposed, taking into account various factors of the working environment and classes of working conditions. An algorithm for selecting personal protective equipment has been developed. The procedure for providing PPE is outlined when employers develop local acts on PPE at their discretion in accordance with the labor legislation of the Republic of Kazakhstan. A model is described that is based on the assessment of occupational risks and offers numerous possibilities to take into account the interests of the state, the employer and the employees. The results of scientific researches received during the scientific and technical program on a theme: «Risk-oriented organizational-economic mechanisms of ensuring of safe labor in conditions of modern Kazakhstan» (IRN OR11865833) within the limits of program target financing of researches of the Republican research institute for occupational safety and health under MLSPP of the Republic of Kazakhstan have been presented.*

Keywords: *personal protective equipment, risk-based approach, occupational risk, methods of providing PPE, government, employer, employee, industrial risk.*

Introduction

Personal protective equipment (hereinafter, PPE) is one of the measures in the established hierarchy of control measures to ensure safe work [1], schematically presented in Figure 1.

According to this hierarchy, PPE is issued only if it is impossible to eliminate the effects of a harmful and/or dangerous production factor and must correspond to the level of necessary protection of the employee.

Eliminating hazards through engineering or administrative controls is the best way to protect people. The strategy used to select controls is called a «hierarchy of controls», in which priority is given to the types of controls that are most effective in eliminating or reducing the risk of exposure to a hazard.

PPE is the least effective method of controlling or preventing exposure to hazards. PPE provides a barrier to protect the employee from potential exposure to hazards, however, due to the fact that the employee depends on the choice, wearing and maintenance of PPE, the probability of exposure to danger only when using PPE increases.

It should be noted that PPE is mandatory to be provided at the expense of the employer.

At the same time, in Kazakhstan, the mechanism for providing PPE is based on the application of the norms for issuing PPE with strict regulation of the names of professions and activities according to the Norms for issuing special clothing and other personal protective equipment to employees of organizations of various types of economic activity, approved by Order No. 943 of the Minister of Health and Social Development of the Republic of Kazakhstan dated December 8, 2015 [2]. The PPE issued to employees must ensure work safety, correspond to their gender, height, size, nature and conditions of the work performed.

However, in the course of research, the absence of PPE has been established in the presence of the impact of the production factor, i.e. their provision does not take into account the real working conditions and

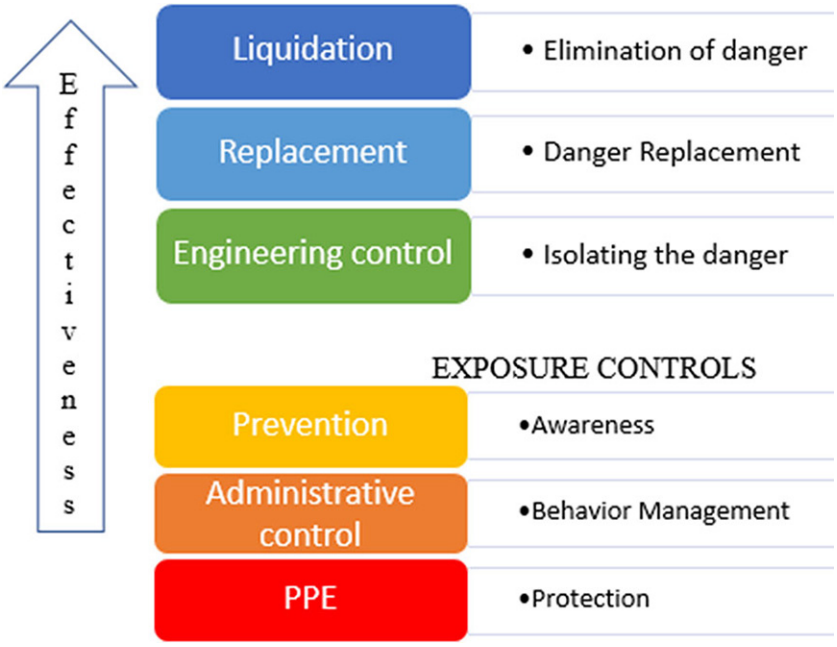

Figure 1 – Hierarchy of control measures

professional risks of each employee. Employers are limited by legal requirements to provide high-quality PPE, in accordance with the established norms and conditions of their purchase. Numerous documents (volumes) on the norms of issuing PPE are inconvenient to use.

It should be noted that in the Republic of Kazakhstan, an assessment of the security of PPE employees is also carried out during the certification of production facilities according to working conditions, which is carried out by a specialized accredited organization.

The assessment of the security of PPE employees is carried out through the consistent implementation of the following procedures [3]:

- comparison of the nomenclature of actually issued PPE with the corresponding standard norms of free issuance to PPE employees;
- checking the availability of certificates (declarations) of compliance with PPE issued to employees;
- verification of the established procedure for providing employees with PPE;
- assessment of compliance of the issued PPE with the actual state of working conditions at the workplace.

When assessing the security of PPE employees, an additional assessment of the effectiveness of PPE issued to employees can be carried out.

A more expanded mechanism for assessing security is being implemented as part of the assessment of occupational risks based on the results of workplace certification.

According to the assessment of occupational risks at specific workplaces, the list of PPE should be expanded in accordance with the identified production factors.

In this regard, Kazakhstan has all the prerequisites for the introduction of a new risk-based approach, according to which the issuance of PPE will be organized based on the results of an assessment of professional risks. This will allow you to choose effective means of protection, taking into account the actual working conditions at each workplace. To do this, it is necessary to determine the methodology for providing PPE using a risk-based approach.

Research methods and materials

The work uses modern methods of scientific research, such as documentary analysis, comparative methods and methods of systematization and grouping.

Discussion of the results

Taking into account the experience of foreign countries, namely the countries of the European Union [4, 5] and the USA [6], it can be concluded that their assessment of the security of PPE workers is carried out in the presence of the results of an assessment of compliance of working conditions with hygienic standards and an assessment of workplace risks.

In the USA, there is a practice established by the federal agency OSHA (supervision in the field of occupational health and safety), indicating the obligation of companies to provide personal protective equipment [7]. Occupational Safety and Health Administration (OSHA) standards require employers to provide personal protective equipment when necessary to protect workers from work-related injuries, illnesses and deaths.

The type and nature of hazards in the workplace will be the main indicator of the correct type of PPE.

Prevents or adequately controls the associated risks without increasing the overall risk level?

Employees are given instructions about the risks that can be avoided or limited with the help of PPE, about the reasons for using PPE, about how to use them safely and effectively, about the actions necessary for the employee to maintain them in good condition, for example, about cleaning, replacement, storage (such instructions should be understandable to persons to whom it is provided). Employers take reasonable measures to ensure that employees are used correctly. Employees themselves are also required to use PPE in accordance with their training, report loss or defect, and store PPE in accordance with the instructions. The self-employed are also required to make full and proper use of PPE.

The Washington State Department of Labor and Industry [8] requires all employers to evaluate their workplace for hazards that may require the use of PPE. If it is necessary to use PPE, the manager must select the appropriate equipment and require its use.

Each manager is obliged to check all the workplaces of his employees for the need to use PPE. The rules, the degree of danger and the available technical or administrative controls will determine which PPE is needed. If departments will use PPE to protect personnel, the following points must be followed:

- Evaluate the workplace for the presence of hazards;
- Choose suitable PPE;
- Make sure that PPE is used;
- Establish inspection, maintenance and replacement procedures to ensure that damaged PPE is not used;
- Train employees in the proper use, restrictions, care and maintenance of PPE;
- Document evaluation, selection and training.

If all of the above items are documented in existing department procedures, such as laboratory safety guidelines, standard operating procedures, or workplace hazard analysis for all employee workplaces, then no further work is required. When a hazard assessment shows that PPE is needed, hiring departments should provide PPE to employees free of charge. The exceptions are safety glasses and safety shoes. If the hazard assessment determines that PPE is not needed, then document the risk assessment.

The algorithm for providing PPE is described below [9].

Step One: Evaluation. A job, process, or procedure that is going to be evaluated is selected for evaluation. It is necessary to inspect the work site and determine the dangers to which the employee will be exposed during the work. Use one of the EH&SE risk assessment guidelines or their own worksheet to list the identified hazards.

Step two: Choosing a PPE. If it is necessary to use PPE, then you need to list the PPE that will be used for each hazard. The supervisor or the person conducting the evaluation and selection must sign the form and put the date.

Step three: Training. After evaluation and selection, employees who need to use PPE should be trained before they need to use PPE. Retraining should be carried out in case of changes in the requirements for PPE and as necessary.

Step Four: Documentation. Enterprises should store the following information to document hazard assessment, PPE selection and training:

- The work, process or activity being evaluated.
- Identified hazards.
- Selection of PPE used for each identified hazard. You may need to specify the type, brand, model of PPE.
- The person or position defined for the use of PPE.
- Name and position of the person who conducted the hazard assessment.
- Date of completion of the hazard assessment.
- Name, position, date of training of all employees who need to be carried with them.

In the Russian Federation, the provision of personal protective equipment consists of two stages [10].

The first stage consists in determining the procedure for issuing PPE, the compliance of the set and the degree of their provision with the requirements of Standard industry Standards.

At this stage, you should check:

a) The availability of internal regulations for the issuance of overalls, safety shoes and other personal protective equipment. As a rule, such norms are approved by the heads of the enterprise and included in the relevant section of the Collective Agreement.

b) Compliance of internal standards with Standard industry standards in terms of the extent to which they cover employees of the enterprise, according to the list of issued protective equipment and their number. Here it is also necessary to determine which PPE are issued as duty.

Typical features identified when checking on this item are:

- non-compliance of the factory list of professions and positions with the list of Standard industry standards. If the factory list is broader, for example, it includes the positions of shop and factory administration, this is not a disadvantage. The disadvantage should be considered the absence of any professions and positions in the factory list, if they are present in the Standard Norms;
- insufficient list of issued personal protective equipment. Usually such non-compliance with the norms is explained by the use of the already canceled edition of Standard Industry Norms for the compilation of factory standards;
- an indication of the use of some types of PPE as duty, although according to Standard Standards they are issued for personal use;
- at some enterprises, the list of personal protective equipment includes devices for safe work and devices for operational control of the parameters of the production environment. Although, strictly speak-

ing, these are not personal protective equipment, this should not be considered a serious disadvantage, however, information about them should not be included in the PPE security assessment protocol, but in the injury safety assessment protocol.

c) The procedure for issuing workwear, safety shoes and other personal protective equipment to employees. Verification on this item is most easily carried out by analyzing personal records of the issuance of personal protective equipment. Using the card, it is easy to determine whether the list of PPE assigned to this employee complies with factory and Industry standards. The card also allows you to determine whether the list of required PPE has changed when an employee changes his profession or place of work at the enterprise.

Typical features identified in the analysis of cards are:

- the absence of personal accounting cards or their outdated form;
- lack of information about the gender and size of clothing, shoes, etc.;
- non-compliance of the PPE list shown on the front side of the card with factory and/or industry standards;
- inconsistency of the list of actually issued PPE with the list of PPE that are supposed to be issued. This is especially true for frequently replaced products: mittens, lightweight respirators. The inspector may be explained that some types of PPE are issued in unlimited quantities, for example, anti-noise plugs, and they are not taken into account in the personal card. The truthfulness of this can be established directly in the workshop, having familiarized with the availability and accessibility of containers with plugs.
- absence of marks on the return of used PPE;
- non-compliance with the terms of replacement of PPE.

d) Visits to workplaces and conversations with employees. Having visited workplaces (ideally, everything, although in practice, as a rule, selectively), the inspector can make sure whether the workers use the protective equipment issued to them, whether all the necessary PPE are really issued, whether they correspond to gender, size, whether there are delays in issuing, whether repairs and washing are organized, satisfy whether the quality of PPE workers. This stage of verification should be carried out as delicately as possible, determining who is to blame for the violations committed: the employees themselves or the administration of the enterprise.

Typical features identified at this stage are:

- dissatisfaction of employees with the appearance, size, height, gender compliance of workwear and shoes;
- low quality and rapid wear of products that cannot last the period established by the norms;
- complaints about the lack of repair and washing of workwear;
- the absence of replaceable components of workwear necessary for the duration of the main set being washed (cleaned);
- low protective properties of products, for example, lack of fire resistance in electric welders' suits.

At this stage, the work on the first stage can be considered completed. The results are drawn up in the form of a protocol, where information is entered for each certified workplace. The identified shortcomings are described in the final part of the protocol. Here are also suggestions for improving the provision of workers with personal protective equipment.

It is easy to notice that the described stage, which is often limited to work, does not answer a very important question: do the protective properties of personal protective equipment issued to employees correspond to the conditions of the production environment and the nature of work. The second stage of the assessment will help to find out.

To start work on this stage, it is necessary to have protocols for studying the factors of the production environment, a protocol for assessing injury safety and, of course, a protocol for assessing the availability of personal protective equipment. It is necessary to compare the properties of the actually issued PPE to the conditions of the production environment, data on which are available in the protocols. This applies, first of all, to special protective clothing. Since the Standard Industry Norms [10] provide types of workwear without specifying their protective properties, it is necessary to visually determine according to documents and, if necessary, whether, for example, a cotton suit issued to an employee can protect him from high concentrations of toxic dust found in the workplace.

According to the analysis of the protocol for assessing injury safety and directly at the workplace, it should be determined whether it is necessary to use a protective helmet, face shield, protective glasses, whether they are correctly selected for their protective properties. It should also be determined whether the issued hand and foot protection products are able to protect the employee from injury.

Particular attention should be paid to the assessment of compliance with the conditions of the production environment of the issued personal protective equipment of the respiratory organs: whether the brands of gas masks are correctly selected, whether their protective properties are sufficient at the detected concentrations of harmful substances. The assessment carried out according to the documents, in many cases, should be continued directly at the workplace.

Having worked through the Russian experience in the field of PPE security, it can be concluded that a transitional stage is currently underway from standard norms to a risk-oriented approach.

Taking into account the international experience in the Republic of Kazakhstan, when switching to a risk-oriented approach in accordance with the peculiarities of production and the results of risk assessment, one type of PPE provided for by the Norms can be supplemented or replaced by another, similar

in protective properties and hygienic characteristics, with wear periods provided for by the PPE nomenclature [11].

Below is a schematic representation of the methodology developed by the authors for providing PPE, taking into account the assessment of occupational risk (Figure 2).

According to the proposed scheme (Figure 2), it can be seen that the employer (together with employee representatives) develops local acts on the PPE at its discretion.

It is recommended to include the following items here:

- the procedure for providing PPE for employees of this organization;
- the order of storage, serviceability, testing, washing, drying, repair and replacement of PPE;
- the order of acceptance of PPE from suppliers, their delivery by employees to the warehouse, as well as disposal;
- the composition of the commission for the evaluation of PPE received from suppliers and employees to the warehouse;
- procedure and criteria for the evaluation of PPE;
- the procedure for collecting material damage.

In the local act, it will be necessary to prescribe the procedure for providing PPE, which will be convenient for this particular organization. In the regulation, you need to describe how applications are processed, the procedure for issuing, handing over and accounting for PPE, their reception and storage. Since protective equipment is not eternal, it is also necessary to prescribe in the regulation the procedure for writing off and disposing of personal protective equipment. Special attention should be paid to the description of measures for the care of PPE, as well as responsibility for non-compliance with requirements. Responsible persons should be appointed depending on what services and specialists there are and what policy the organization adheres to in the field of labor protection.

An algorithm for selecting personal protective equipment has been developed (Figure 3).

Also, the modernized mechanism for providing PPE should take into account the roles of the «Employer-State-Employees (employee representative)» as a single system interacting in the correct selection of PPE and leading to safe work (Figure 4).

Conclusion

In the modern conditions of market economy development, the transition from a unified regulatory approach in providing PPE to a model based on the assessment of occupational risks will give broader

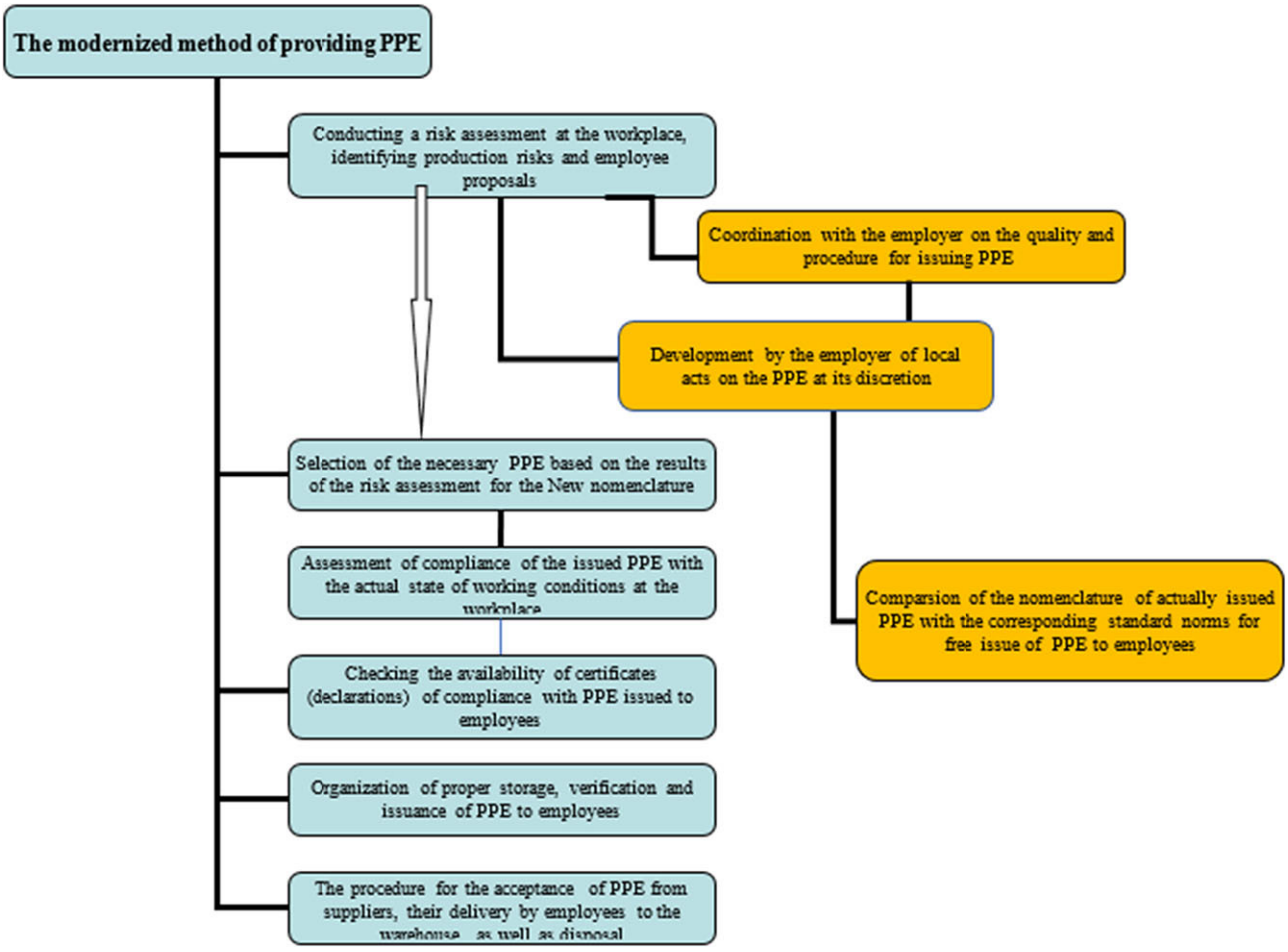

Figure 2 – Methods of providing PPE

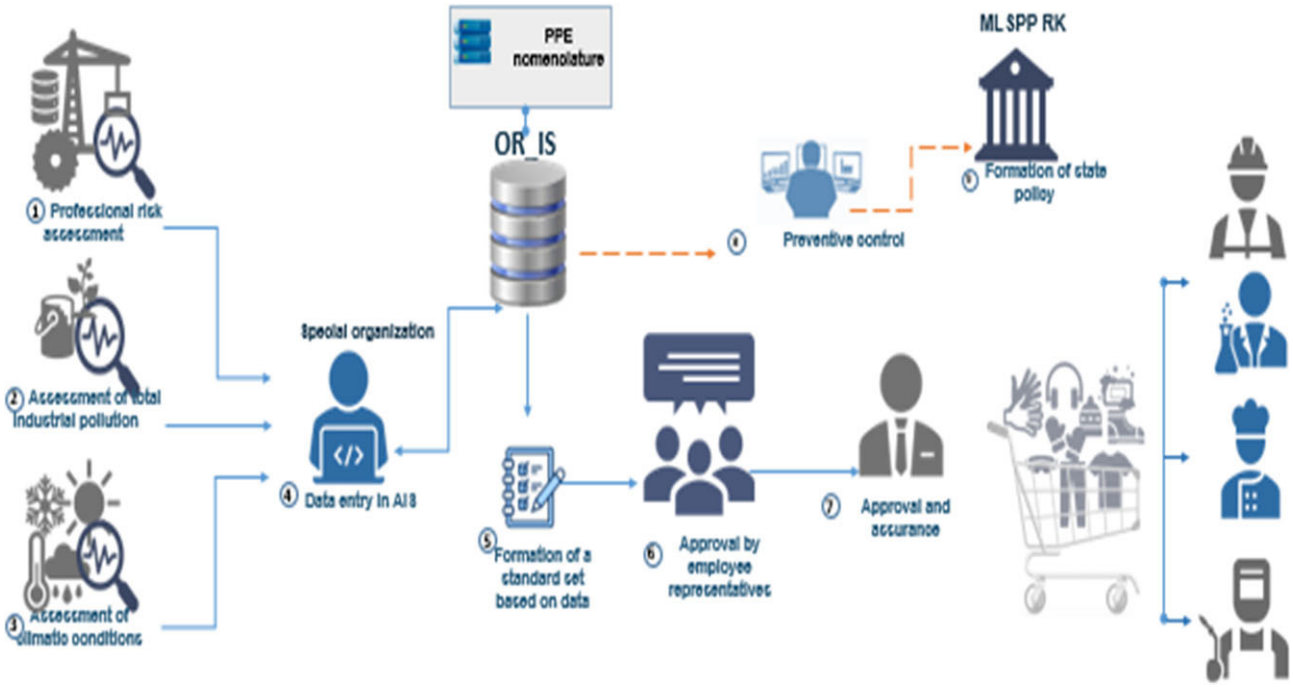

Figure 3 – Algorithm for the selection of personal protective equipment

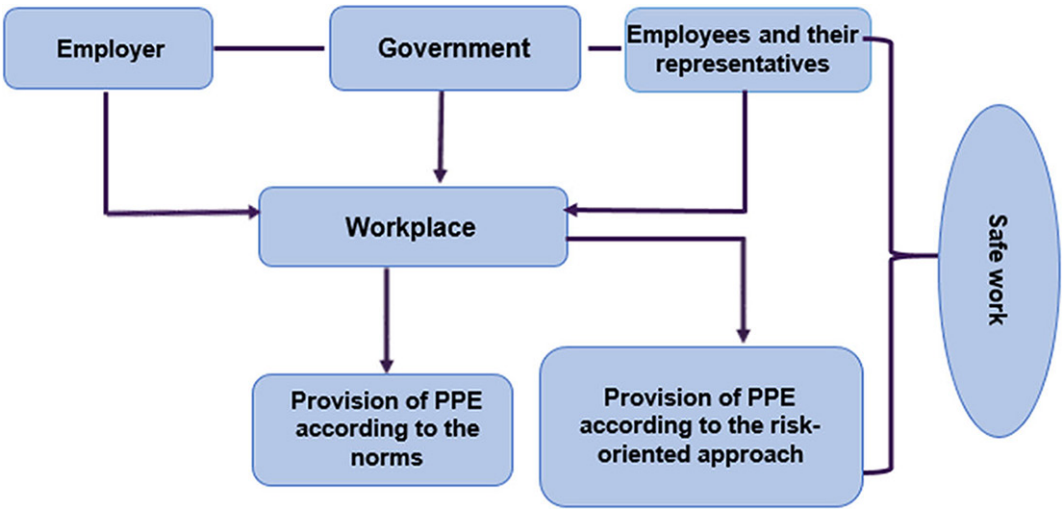

Figure 4 – A single system interacting in the correct selection of PPE

opportunities to respect the interests of the State, the employer and the employee.

At the State level, the introduction of a risk-based approach in providing PPE is carried out in accordance with legislative acts, norms and rules. The assessment of occupational risks should be carried out jointly with state inspectors and the trade union on the part of employees.

At the employer level, the introduction of a risk-based approach should be accompanied by timely and correct selection of PPE, taking into account the identified production risks at specific workplaces.

At the employee level, the use of PPE, taking into account a risk-based approach, reduces production risks and creates safe working conditions.

Thus, the new approach in providing PPE has practical value and significance at all levels of management in the field of occupational safety.

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Кәсіби тәуекелді ескере отырып жеке қорғаныс құралдарын таңдау туралы

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***Аңдатпа.** Мақалада Қазақстан Республикасындағы тәуекел-бағдарланған тәсіл негізінде жеке қорғаныс құралдарын қаттамасыз ету әдістемесін жаңғырту бойынша ұсыныстар берілген. АҚШ мысалында жеке қорғаныс құралдарымен қаттамасыз ету тәжірибесі ұсынылған. ЖҚҚ қаттамасыз етудің ресейлік тәжірибесі талданды және оларды беру кезіндегі типтік ерекшеліктер анықталды. Кәсіби тәуекелді бағалауды ескере отырып, ЖҚҚ қаттамасыз ету тәртібі келтірілген. Өндірістік ортаның әр түрлі факторлары мен еңбек жағдайларының кластарын ескеретін жаңа номенклатура бойынша ЖҚҚ-мен қаттамасыз ету алгоритмі ұсынылды. Жеке қорғаныс құралдарын таңдау алгоритмі әзірленді. Қазақстан Республикасының еңбек заңнамасын сақтауға сәйкес жұмыс берушілердің ЖҚҚ-ға жергілікті актілерді өз қалауы бойынша әзірлеу кезінде ЖҚҚ-мен қаттамасыз ету тәртібі баяндалған. Мемлекеттің, жұмыс берушінің және қызметкерлердің мүдделерін сақтауға кең мүмкіндік беретін кәсіби тәуекелдерді бағалауға негізделген модель сипатталған. ҚР ЕХӘҚМ Еңбекті қорғау жөніндегі республикалық ғылыми-зерттеу институтының зерттеулерін бағдарламалық-мақсатты қаржыландыру шеңберінде «Заманауи Қазақстан жағдайында қауіпсіз еңбекті қаттамасыз етудің тәуекел-бағдарланған ұйымдастырушылық-экономикалық механизмдері» (ЖТН OR11865833) тақырыбына ғылыми-техникалық бағдарламаны іске асыру барысында алынған ғылыми зерттеулердің нәтижелері ұсынылған.*

***Кілт сөздер:** жеке қорғаныс құралдары, тәуекел-бағдарланған тәсіл, кәсіби тәуекел, ЖҚҚ қаттамасыз ету әдістемесі, мемлекет, жұмыс беруші, жұмысшы, өндірістік қатерлер.*

О выборе средств индивидуальной защиты с учетом профессионального риска

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Аннотация. *В статье даны рекомендации по модернизации методики обеспечения средствами индивидуальной защиты на основе риск-ориентированного подхода в Республике Казахстан. Представлен опыт обеспечения средствами индивидуальной защиты на примере США. Проанализирован российский опыт обеспечения СИЗ и выделены типичные особенности при их выдаче. Приведен порядок обеспечения СИЗ с учетом оценки профессионального риска. Предложен алгоритм обеспечения СИЗ по новой номенклатуре, учитывающей различные факторы производственной среды и классы условий труда. Разработан алгоритм выбора средств индивидуальной защиты. Изложен порядок обеспечения СИЗ при разработке работодателями локальных актов на СИЗ по своему усмотрению согласно соблюдению трудового законодательства Республики Казахстан. Описана модель, построенная на оценке профессиональных рисков, которая дает широкие возможности в соблюдении интересов государства, работодателя и работников. Представлены результаты научных исследований, полученные в ходе реализации научно-технической программы на тему: «Риск-ориентированные организационно-экономические механизмы обеспечения безопасного труда в условиях современного Казахстана» (ИРН OR11865833) в рамках программно-целевого финансирования исследований Республиканского научно-исследовательского института по охране труда МТСЗН РК.*

Ключевые слова: *средства индивидуальной защиты, риск-ориентированный подход, профессиональный риск, методика обеспечения СИЗ, государство, работодатель, работники, производственные риски.*

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11. Nomenclature of personal protective equipment depending on harmful production factors and the degree of their impact. Copyright certificate No. 28600 dated 06.09.2022 Applicant: RSE with REM «RIIOS MLLSP RK», Astana, 2022.