

## **INSTRUMENTAL MONITORING AND ASSESSMENT OF OCCUPATIONAL RISK IN UZBEKISTAN**

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### **Abstract**

The methods of control and assessment of professional risk applied in the republic do not include the method of assessment of the degree of impact of harmful and dangerous factors of working conditions on specific employees, as well as the analysis of actual loss of working capacity of employees after long periods of labor activity. As a result of incorrectly chosen assessment methods and methodological approach, working conditions have a high risk of developing professional and professionally conditioned morbidity among groups of professions in industries. The purpose of this work was to determine the improved approaches to professional risk assessment and instrumental control over their implementation. Assessment of workers' health indicators depending on working conditions at the workplace is based on recommendations of the International Labor Organization. We have developed a package of normative and methodical documents, including 14 methodical recommendations, as well as Sanitary Rules and Norms, providing requirements to the hygienic assessment of the impact of various physical, chemical and biological factors on the health of workers. Conclusions were made to integrate the characteristics of the factors of working conditions through the transition from the normalization of individual parameters of the factors to complex indicators, changing the methodology of recording the working conditions at the working places to ensure a comprehensive assessment of all risks in a single procedure and their systematic monitoring. The use of modern software complexes as part of special devices for instrumental measurements have a loaded algorithm of measurements, pre-compiled a special computer program control planning, which offers the performer an operational hint on the choice of place and number of measuring points.

**Keywords:** working conditions, workplace, morbidity, measurement, employees, professional risk.

In Uzbekistan, the concept of occupational risk was introduced in 2017 and is firmly established in occupational health and safety management [1]. A combined solution to many methodological, insurance, clinical, rehabilitative, preventive and diagnostic problems is required to form an efficient universal social insurance institution against accidents and occupational diseases. Occupational risks, defined as the probability of health damage or loss of ability to work or death of a worker due to exposure to harmful and/or hazardous industrial factors, must have a scientifically grounded method of their assessment 2.

Assessment of real risks using existing methods of risk assessment for individual risk factors and their consideration for large occupational groups and using hygienic assessment of combined exposure to risk factors can only serve as a preliminary stage. This is because the methods used do not include in the arsenal of their assessments method of assessing the degree of exposure to harmful and hazardous factors of working conditions for specific workers and the analysis of actual disability of workers after long periods of work. As a result of incorrectly chosen assessment methods and methodological approach, working conditions have an unfavourable background that causes a high risk of developing professional and professionally conditioned morbidity among professions in industries 3, 4, and 5.

The legislation of the Republic of Uzbekistan defines the legal status of the insurer performing the whole range of relevant functions, which will significantly improve the social protection of workers, which is one of the central tasks of social insurance.

The work aims to define new approaches to professional risk assessment and instrumental control over their implementation.

Methods of research. The assessment of individual risk factors of the production environment is carried out according to the generally accepted methodology, based on the results of workplace assessment, with subsequent determination of the class of working conditions on the indicators of harmfulness and danger of the production environment factors, severity and intensity of the work process [6,7]. Attestation of workplaces allows to define and estimate the most important factors of professional risk from the point of view of probabilistic characteristics of negative consequences for an employee, and also to receive the general idea of levels of professional risk on different risk factors and as a whole for large professional groups [8].

Quantitative methods of assessing the level of impact of a harmful factor on the human body during the period of its labor activity are carried out in a complex, in-depth analysis of risk factors with the help of improved measuring instruments - instrumental control [9, 10].

Assessment of workers' health indicators depending on working conditions at the workplace is based on recommendations of the International Labour Organization (ILO) - ILO SUOT 2001/ILO-OSH 2001 11.

**Results and discussions** In Uzbekistan, the perspective direction of development of national legislation is its improvement based on internationally adopted documents by the World Health Organization and International Labour Organization (hereinafter - ILO), which provide for the assessment and control of occupational health risks, primary prevention of risk factors for the development of general, industrial and occupational diseases and strengthening the human resource potential. The management of occupational risks is important to workers' health, as confirmed by ILO Convention 161 (Geneva, 1991).

For hygienic assessment of compliance of working conditions by production factors to their normalized values, we have developed a package of regulatory and methodological documents, including 14 methodological recommendations, as well as Sanitary Rules and Norms, providing requirements for hygienic assessment of the impact of various physical, chemical and biological factors on the health of workers:

- SanPiN RUz <sup>1</sup> 0327-16 "Requirements for the organization of measurements of hazardous and harmful production factors in hygienic conformity assessment";

- "Identification of hazardous and harmful production factors in laboratory research on assessment of working conditions" (methodological recommendations approved by the Ministry of Health of the Republic of Uzbekistan № 012/3-0246 from 06.12.2013, Tashkent, 2013, 11 p.);

- "Methods of measuring the content of harmful substances in the air of the working zone by gas and dust analyzers" (methodological recommendations approved by the Ministry of Health of the Republic of Uzbekistan № 012-3/0242 of 04.10.2013, Tashkent, 2013, 18 p.);

- "Methods of assessment of biological factor of working conditions" (methodological recommendations approved by the Ministry of Health of the Republic of Uzbekistan № 012-3/0311 of 19.06.2017, Tashkent, 2017, 14 p.);

- "Methods of measuring indicators of microclimate at work places" (methodological recommendations approved by the Ministry of Health of the

Republic of Uzbekistan № 012-3/0245 from 06.12.2013, Tashkent, 2015, 9 p.);

- "Methods of measuring indicators of illumination at work places" (methodological recommendations approved by the Ministry of Health of the Republic of Uzbekistan № 012-3/0248 of 19.12.2013, Tashkent, 2013, 16 p.);

- "Methods of measurement of electromagnetic fields at work places" (methodological recommendations approved by the Ministry of Health of the Republic of Uzbekistan № 012/3-0266 of 14.10.2014, Tashkent, 2014, 12 p.);

- "Methods of measurement of infrasound at the workplace" (methodological recommendations approved by the Ministry of Health of the Republic of Uzbekistan № 012-3/0285 of 25.01.2016, Tashkent, 2016, 10 p.);

- "Methods of measurement of laser radiation" (methodological recommendations approved by the Ministry of Health of the Republic of Uzbekistan № 012-3/0267 from 14.10.2014, Tashkent, 2017, 9 p.);

- "Methods of measurement of ultraviolet radiation" (methodological recommendations approved by the Ministry of Health of the Republic of Uzbekistan № 012-3/0253 of 27.06.2014, Tashkent, 2017, 8 p.);

- "Methods of measurement of aeroion composition of air in production and public premises" (methodological recommendations approved by the Ministry of Health of the Republic of Uzbekistan № 012/3-0252 of 26.06.2014, Tashkent, 2017, 12 p.);

- "Method of dust assessment" (methodological recommendations approved by the Ministry of Health of the Republic of Uzbekistan № 012-3/0310 from 15.06.2017, Tashkent, 2017, 11 p.);

- "Methods of reducing the class of working conditions taking into account the effectiveness of the used personal protective equipment" (methodological recommendations approved by the Ministry of Health of the Republic of Uzbekistan № 012-3/0276 of 18.11.2015, Tashkent, 2015, 8 p.);

- "Methods of reducing the class of working conditions taking into account the determination of the duration of time of safe exposure to factors of working conditions and time protection" (methodological recommendations approved by the Ministry of Health of the Republic of Uzbekistan № 012/3-0317 from 28.08.2017, Tashkent, 2017, 10 p.).

The system of professional risk management includes:

- Planning of work on hazard identification and risk assessment;
- assessment of working conditions at each workplace;
- health assessment of employees;
- risk reduction measures;

- control over the implementation of risk reduction measures.

The system of professional risk assessment solves several tasks related to obtaining scientifically grounded data on the actual level of risk to the employee's health depending on the actual working conditions, correction of hygienic norms, development of systems and means of collective and individual protection and evaluation of their effectiveness, taking grounded decisions for risk reduction (protection of employee's health), substantiation and calculation of insurance payments in the system of compulsory social insurance, as well as the ranking of organizations by the level of risk.

The risk assessment included several sequential stages: hazard identification, identification of the number of victims, risk assessment and precautionary measures, registration of the assessment results, implementation of planned activities and the final stage - review of the risk assessment and its improvement.

The main sources for obtaining information on identification of possible risks (hazards) were: normative legal acts, reference books, branch and interbranch rules; results of inspections of supervision bodies; results of production control; results of certification of workplaces; maintenance of a register of chemicals used in production; determination of properties that should have PPE; availability of instructions for each workplace; availability of equipment operation manual; surveillance of the working environment; questionnaires for each workplace. When determining the contingent of victims, all harmful factors, forms of infliction of harm (injury, disease) to workers' health and the method of their influence are assessed, taking into account that the work of some categories of workers is associated with increased safety requirements.

The process of risk assessment and determination of precautions was carried out in the following order: application of less risky variants (for example, application of less hazardous chemicals); elimination of access to harmful factors, correct organization of work using measures reducing the degree of influence of harmful factor - rational application of personal and collective protection means; provision of household premises (first aid station, showers, pollution removal rooms). Recording the obtained results of risk assessment and informing the staff about them contributed to the improvement of working conditions and better awareness of the employer about possible risks, about persons exposed to the hazardous influence of harmful and dangerous factors, about measures for prevention or minimization of danger and risk assessment with the participation of health

and safety services. Revision of the risk assessment and its improvement was carried out as necessary; new chemicals can cause new threats in applying new equipment.

In Uzbekistan, the results of the first steps of professional risk analysis solve two aspects of the problems: research, where there is a need for scientific justification of algorithms of professional risk assessment, calculation of insurance amounts and practical, where the results of scientific research are formalized in the form of development of methods of risk determination [12]. In practice, research laboratories apply results analysis algorithms based on the data of previously conducted research on causal relationships of risk levels with working conditions. In risk management systems, both quantitative and qualitative methods are used for professional risk assessment.

Quantitative methods are used when there is a sufficient amount of statistical data on the occurrence of undesirable events with severe consequences: injuries and occupational diseases of varying degrees of severity. If there is a lack of sufficient statistical data for the analysis, qualitative methods are based on the analysis methods by an expert assessment of working conditions (Fine - Kinney method). Based on the results of the above-mentioned professional risk analysis methods, tables demonstrating the dependence of the risk level(category) and the probability ratio of the event to the severity of its consequences are constructed. These data make up the so-called risk matrix used to visualize intermediate and final results [13].

It is known that the assessment of occupational risk uses the results of the hygienic assessment of factors of the working environment and work process, according to the generally accepted hygienic classification of working conditions [14]. Hygienic classification of working conditions by the degree of harm and hazard is close to the internationally accepted characteristics of occupational risk categories. To illustrate indicators of deviations of working conditions from normative values and reveal risks to workers' health, the table on comparison of classes of working conditions with index of occupational diseases, categories of occupational risk, and preventive measures is used (Table 1).

Table 1.

**Comparison of working conditions classes with the occupational disease index, occupational risk categories and prevention measures**

| Class of working conditions | Occupational disease index - | Category of professional risk                         | The urgency of risk reduction measures                                       |
|-----------------------------|------------------------------|---|--|
| 1 (optimal)                 | 0                            | No risk   | No measures are required   |
| 2 (acceptable)              | < 0,05                       | Negligibly small (transferable) risk                  | No action is required, but vulnerable individuals need additional protection |
| 3.1 (harmful)               | 0,05...0,11                  | Small (moderate) risk                                 | Risk reduction measures required   |
| 3.2 (harmful)               | 0,12...0,24                  | Medium (substantial) risk                             | Risk mitigation measures are required within the established timeframe       |
| 3.3 (harmful)               | 0,25...0,49                  | High (intolerable) risk                               | Urgent risk reduction measures are required                                  |
| 3.4 (harmful)               | 0,5...1,0                    | Very high (intolerable) risk                          | Work cannot be started or continued until the risk has been reduced.         |
| 4 (dangerous)               | > 1,0                        | Ultra-high risk and inherent risk to life professions | The work should only be performed regulatory                                 |

The EF value (Table 2)-an etiological fraction was characterizing (in percentage) the likelihood of health disorders at a given risk level-is introduced to explain the association of professionally induced health disorders with risk indicators.

Table 2.

**Level of the causal link between health disorders and occupational risk categories**

| Occupational risk category           | Occupational disease index | Type of health impairment       | Etiological Fraction - EF, % |
|--------------------------------------|----------------------------|---------------------------------|------------------------------|
| No risk.                             | 0                          | General diseases                | 0                            |
| Negligible small (transferable) risk | < 0,05                     |                                 |                              |
| Small (moderate) risk                | 0,05...0,11                |                                 |                              |
| Medium (significant) risk            | 0,12...0,24                | Professionally-related diseases | 0,33 - 0,50                  |
| High (intolerable) risk              | 0,25...0,49                |                                 | 0,51 - 0,66                  |
| Very high (intolerable) risk         | 0,5...1,0                  |                                 | 0,67 - 0,80                  |

|                     |       |                       |             |
|---------------------|-------|-----------------------|-------------|
| Ultra-high risk and | > 1,0 | Occupational diseases | 0,81 - 1,00 |
|---------------------|-------|-----------------------|-------------|

The Research Institute of Sanitation, Hygiene and Occupational Diseases of the Ministry of Health of the Republic of Uzbekistan have developments in the field of classification of working conditions at the workplace to describe the consequences of working in optimal, acceptable or harmful working conditions. The definitions of occupational risk by describing the consequences of working in conditions of small, medium or high risk are proposed.

A comparison of these data allows establishing a mutually unambiguous correspondence between classes of working conditions and categories of professional risk. Therefore, risk assessment is a serious measurement base, where domestic developments in the field of classification of working conditions are applied, based on laboratory research of the working environment at the workplace.

**Conclusions.** Thus, to solve the complex of problems arising in the field of assessment and instrumental control of professional risk, it is necessary:

- the integration of characteristics of the factors of working conditions by moving from the normalization of individual parameters to complex indicators that combine a family of parameters that mutually compensate or enhance each other's action. As a result, there remains one parameter that directly determines the professional risk of working in these working conditions;

- transition from a simple comparison of measurement results with the norms of parameters of the production environment to taking into account the mechanisms of exposure to hazards on the human body;

- development of measurement techniques (MVI) using the full range of capabilities of modern equipment, from one-time measurements with memorization of results to the organization of permanent centralized monitoring of production conditions;

- use of measuring instruments (MIs), considering the specifics of measurements to assess professional risk. The measuring instruments used for this purpose should provide the possibility of long-term autonomous measurements with memorization of results, integration into control and measuring complexes, including various measuring instruments and expert systems of results analysis.

When carrying out instrumental control, it is necessary to strictly follow the requirements of methods described in regulatory documents: GOST, SanPiN, manuals, etc.

Modern software complexes are used as a part of special devices for instrumental measurements: processor devices loaded with measurement algorithm, pre-compiled by a special computer program for control planning. The process of measuring the device offers the performer an operative hint on the choice of a place and number of measuring points. In addition, the constancy of measurements is ensured, i.e. the made plan of measurements can be used repeatedly. Many modern devices have a standard interface that allows the transmission of the measurement results to the software system in time. The use of this measuring system has its advantages: high level of accuracy of the results in case of repeated measurements (errors of the system are detected automatically, which are stored in the computer memory and processed until the final results are obtained), independence of the system operation from the level of qualification and attention of personnel, high productivity (the automatic system can operate at higher speeds), completeness of tests (a measurement of a large number of parameters in a possibly long time interval), compatibility of the form of presentation of the measurement results with computer data formats (a printout of the results or storage in computer memory), the ability to combine the same type of devices in a multi-point measuring system to monitor conditions at different points of measurement and different devices in the creation of test and measurement systems for a comprehensive examination of one place on different physical factors.

Proceeding from the aforesaid, to ensure the effective work of the social insurance system, the result of the research work on improvement of evaluation mechanisms, instrumental control of professional risks is the preparation of new methodologies, system normative documents, on professional risks evaluation:

- regulations on the identification of hazards and assessment of the risks of injuries in workplaces with harmful and dangerous working conditions;
- regulations for the production control of working conditions at the working places (monitoring);
- methods of integral assessment of working conditions at the working place, taking into account the complex impact of production factors belonging to different classes of harmfulness;

- algorithms for calculating the probability of working capacity loss of an employee depending on the state of working conditions at the workplace;
- algorithms of calculation of individual professional risk depending on working conditions and health condition of the employee;
- methods of calculation of integral indicators of professional risk level in the organization.

To ensure the effective operation of the social insurance system, it is necessary to change the methodology of recording working conditions in the workplace to ensure a comprehensive assessment of all risks within a single procedure and systematic monitoring. In addition to financial indicators, statistics on occupational injuries and morbidity should be considered in determining the tariff.

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