

# Recommendations on the Development of a Hazard Register for Assessing the Level of Risks in the Field of Occupational Health and Safety at Food Industry Enterprises

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**Abstract.** *The results of research on the implementation of the requirements of the ISO 45001 standard in the field of hazard identification and occupational risk assessment to ensure safe working conditions, preservation of life and health of employees of Kazakhstani food industry enterprises are presented. The Deming-Shuhart cycle «Plan-Do-Check-Act» is proposed as a methodology. It has been established that documentation of the hazard identification procedure and risk assessment is carried out through the development of Hazard and Risk Registers. The Register of Identified Hazards for the oil and fat industry enterprise «Shymkentmay» JSC, the Register of Identified Hazards in the production of meat products of «Karkyn-2030» LLP, the Register of Identified Risks for the operator of the ice cream production line of «Balmuzdak» LLP were developed as examples. Identification of hazards makes it possible to form a Risk map for each employee of enterprises that are taken as objects of research, depending on the existing hazards of a particular workplace. On the basis of such a map, an assessment of each risk is carried out with the establishment of its significance in three categories – high, medium and low. Depending on the established significance of the risk, preventive measures are being developed that allow to prevent the risks of occupational diseases and occupational injuries. The developed documents and completed activities serve as proof of compliance with the requirements of the ISO 45001 standard for monitoring, measurement and improvement of the occupational health and safety management system when confirming compliance with the requirements of this standard.*

**Keywords:** *occupational health and safety management system, requirements, ISO 45001 standard, hazards, occupational risks, food industry enterprises, hazard and risk identification, Deming-Shewhart cycle, register, risk assessment.*

## Introduction

One of the significant requirements of the ISO 45001 standard which has been implemented at enterprises since 2018 is the approach of mandatory risk assessment in the field of occupational health and safety of employees, which must be documented to confirm compliance with both this standard and the compliance of the enterprise with legislation in the field of labor protection and safety [1]. The enterprises that have implemented an

occupational health and safety management system and confirmed its compliance with all the requirements of the ISO 45001 standard through an independent certification procedure become evidence that a country that has ratified the International Labor Organization's recommendations is striving to improve working conditions at its enterprises in order to reduce the number of injuries, deaths and occupational diseases caused by poor working conditions in the workplace [2].

Despite the fact that food industry enterprises are not leading in terms of injuries and the number of accidents, however, as in any industrial enterprise that uses a large number of different production equipment, there are occupational safety risks when working on such equipment. The occupational diseases of food industry employees is associated with the use of a sufficiently large number of various chemical reagents in the process of technological processing of raw materials [3].

The features of health protection and labor safety of employees of food industry enterprises are due to the presence of mandatory sanitary and hygienic control at all stages of food production, including monitoring the condition of equipment, premises, assessing the work of personnel, as well as sanitizing equipment, containers, utensils, premises. The optimal working conditions for employees should be provided and appropriate conditions for the production of products should be created at food industry enterprises. Health care of employees involves regular medical examinations of them and their compliance with hygiene rules [4].

In comparison with enterprises in most other industries, *microclimatic conditions* at food enterprises in terms of production facilities are often determined by technological requirements. High or low air temperatures in a number of industrial premises, as well as increased illumination at workplaces, are technologically regulated, since food enterprises are classified as objects with special lighting requirements and it is necessary to carry out visual control over equipment, containers, quality of raw materials and products. Air temperature ranges for a number of production processes (storage and sale of food products, fermentation, defrosting, etc.) are significantly lower or higher than the values allowed by hygienic standards, which often forces us to classify working conditions in the relevant premises as harmful already during the hygienic examination of projects. Most of the surveyed food enterprises are characterized by a large number of pipelines, compressors, pumps, open containers, which are sources of intense vaporization. In the course of technological processes, chemical gaseous substances can be released.

The labor of employees at food enterprises in some cases is characterized by a large movement in space (dairy processing, brewing food industries, and others). There is work with lifting and moving weights, with stereotypical hand movements. The prevalence of manual labor is especially high in the meat processing, baking, and confectionery industries. Emotional overload occurs both in industrial food enterprises and in food trade enterprises and

catering facilities. The uncomfortable working conditions are created in processes accompanied by specific odors (confectionery, fish, meat processing industries) [5].

All of the above factors for food industry enterprises are the objects and initial data for the development of the Register of Identified Hazards, followed by an assessment of potential risks to the health and safety of employees associated with their production activities [6].

Studies of occupational risks at industrial enterprises in the food industry, as one of the types of technogenic risks within the framework of building a health and safety management system according to ISO 45001, are especially relevant for increasing the expert potential of food industry enterprises of the Republic of Kazakhstan, as foreign consumers and companies seek to work with enterprises where health and safety issues are in line with the best world practices [6, 7].

The purpose of the study is to identify the hazards of the working environment at the enterprises of the food industry in the Turkestan region in order to develop a Register of Hazards and assess their level of risk to the life and health of employees.

### Study materials and methods

Identification of hazards in the course of production activities is the process of detecting, identifying and recognizing hazardous and harmful production factors and establishing their quantitative, temporal, spatial and other characteristics necessary and sufficient for the development of preventive measures (preventive and corrective actions) that ensure labor safety [8].

As a methodology for developing processes for identifying existing hazards and assessing their level of risk to the health and safety of an employee, the Deming-Shewhart PDCA (Plan-Do-Check-Act) cycle is used, but at the same time, the transition from the principle of acceptable risk to the mechanism for taking the necessary actions to prevent or reduce undesirable effects from existing risks must be demonstrated [9].

Hazard identification is carried out in several stages [10]:

- preliminary, which analyzes technical and technological documentation to identify and record all hazards and their potential sources in the workplace with a list of works and operations in which this hazard occurs;

- the main stage, that carried out directly at the workplace, which allows us to identify all the hazards, in relation to each specific location of the employee and supplemented by data from previously conducted or specially organized studies, tests and measurements;

- the final stage, during which the analysis of the results obtained is carried out with the development of the Register of Identified Hazards and the assessment of their impact on the risks of occupational diseases and labor safety.

The Register of Identified Hazards should cover all types of hazards and harmful factors: for all those working in the organization and being under the control of the organization, at all stages of the work performance prescribed by the production process technology, in all situations, including all possible extraordinary, dangerous and emergency situations.

In the process of study, we have chosen the workplaces of production processes of food industry enterprises in Shymkent and the Turkestan region – «Shymkentmay» JSC, «Balmuzdak» LLP and «Karkyn-2030» LLP. In order to identify hazards, first it is necessary to identify the types of hazards in the process of manufacturing a food product, which are entered in the form of data in Table 1, the form of which is presented below.

In the food industry, the main hazards are microbiological, chemical and physical. In this regard, it is necessary to identify them and form a Map of the types of hazards for each production. The obtained initial data of key hazards and harmful factors are distributed by type of work of each production unit and describes the possible consequences (risks) for the life and health of an employee performing

his labor functions at a particular workplace. The Register of Identified Hazards in the divisions of the enterprise is given in the form of a template in Table 2.

When filling out the register of hazards it is indicated:

- in column 1 – in numerical characters the serial number of the hazard;
- in column 2 – the name of the type of work of the production process;
- in column 3 – identified hazard;
- in column 4 – the possible consequences of a hazardous event that may bring a harm.

The completed data in Table 2 serve as the initial information for the formation of the Register of Identified Risks, shown in Table 3.

The hazard code is formed on the basis of the «Hazard Classifier», which is developed as a local internal regulatory document by each enterprise with reference to the object under study i.e. the workplace (work area) and the work performed [p.26, 11].

The final result of the risk assessment gives the significance of the risk for the particular occupation under study.

Subsequently, risk identification is used to develop the Identified Occupational Risk Assessment Map, to carry out preventive measures for incidents of any severity. Its template form is shown in Table 4. The Occupational Risk Assessment Map is combined with the hazards for each occupation of the workforce.

**Table 1 – Types of hazards and hazardous factors in production (name of food products)**

Name of types of hazards	Danger factor
1	2

**Table 2 – Form of the Register of Identified Hazards in the divisions of the enterprise**

№	Types of jobs	Name of danger, nature of action	Possible consequences
1	2	3	4

**Table 3 – Register of Identified Risks**

Name of workplace / subdivision	Number of risk assessment map	Labor function	Hazard code	Name of identified hazards	The final result of the risk assessment	Significance of risk
1	2	3	4	5	6	7

### Results and discussion

The developed stages of the formation of the Register of Identified Hazards and risks with an assessment of the degree of their severity for the life and health of employees and their documentation made it possible to develop:

- the main types of risks in the production of edible vegetable oils, shown in Table 5 on the example of «Shymkentmay» JSC,

- types of hazards in the production of meat products of «Karkyn-2030» LLP, shown in Table 6.

- classification of hazardous and harmful production factors by type of work at «Balmuzdak» LLP is given in Table 7 and on the basis of it the Register of Identified Risks for the main workplace – the operator of the ice cream production line of «Balmuzdak» LLP is developed. It is presented in Table 8.

Determination of the main sources of harmful production conditions for employees

of «Shymkentmay» JSC, forms risks, according to the types of dangers existing for them.

In the meat industry, the main hazards are microbiological, chemical and physical.

For each potential hazard, a risk analysis is carried out, the likelihood of implementation and the severity of the consequences of the hazard.

The classification of hazardous and harmful production factors by type of work at the enterprises of the dairy industry, using the example of the ice cream production of «Balmuzdak» LLP is shown in Table 7.

Based on these data, the Register of Identified Risks for the occupation (ice cream production line operator of Balmuzdak LLP, table 8) was compiled.

His main job function is to manage the technological process of ice cream production. The hazard code is the highest – 1, as it is subject to all kinds of risks. In this regard, the significance of the risk for this occupation is high.

**Table 4 – Occupational Risk Assessment Map**

No	Danger	Work in progress	Source of risk	Risk management measures	Risk assessment	Risk attitude
1	2	3	4	5	6	7

**Table 5 – The main types of risks for employees of «Shymkentmay» JSC, depending on the type of hazard**

Hazard types	Impacts	Types of risks
Chemical	Vegetable dust, vapors and gases. Inhalation, skin penetration, contact with liquid or semi-liquid substances (gasoline, benzene), powders (bleach)	Diseases: silicosis, bronchitis, atopic diseases, neurological disorders among employees in contact with organic solvents – benzyl, benzene
Physical	Noise, high and low ambient temperature, radiation, vibration, barometric pressure	Decrease or loss of hearing, vibration disease, hypothermia, frostbite, heat stroke, ionizing radiation, visual impairment or eye injury, decompression sickness, inert gas poisoning, aseptic bone necrosis, tendon sprain, carpal tunnel syndrome, lower back pain, falls
Biological	Exposure to the body of infectious microorganisms, toxic substances of biological origin and animal bites	Histoplasmosis, lung infections, influenza, tuberculosis, malaria, yellow fever, sand sickness, skin rash, allergies, animal and insect bite diseases
Social (psychophysiological)	Heavy work load, stresses of various nature, remoteness from the family, conflicts with superiors, with co-workers	Nervous diseases, stress breakdowns

**Table 6 – Types of hazards in the production of meat products of «Karkyn-2030» LLP**

Name of types of hazards	Danger factor
Microbiological	1.1 Number of mesophilic aerobic and facultative anaerobic microorganisms 1.2 Bacteria of the Escherichia coli group 1.3 Sulfite reducing clostridia 1.4 S. aureus 1.5 Pathogenic, including salmonella 1.6 L. monocytogenes (for pates)
Chemical	2.1 Toxic elements (lead, cadmium, mercury, arsenic) 2.2 Antibiotics (levomycetin, tetracycline group, bacitracin) 2.3 Pesticides: hexachlorocyclohexane ( $\alpha$ -, $\beta$ -, $\gamma$ -isomers), dichlorodiphenyl trichloromethylmethane and its metabolites 2.4 Detergents 2.5 Sodium nitrite RD per product 2.6 The amount of total phosphorus (in terms of $P_2O_5$ ) 2.7 Food additives (stabilizers, thickeners, dyes)
Physical	3.1 Employees personal items 3.2 Details of technological equipment 3.3 Foreign materials 3.4 Insects, remains of rodents

**Table 7 – Classification of hazardous and harmful production factors by type of work at «Balmuzdak» LLP**

Types of hazard	Types of impact
Physical	1 – moving machines, mechanisms, unprotected moving parts of equipment, such at the site for the production of ice cream are various kinds of conveyors that transport products between different equipment, a cradle conveyor that moves ice cream to the hardening tunnel and, in addition, dosing devices; 2 – increased temperature of the equipment (unprotected parts of conveyors, packing machine knives having a temperature of 200 C) or low temperature of the equipment (cradle conveyor exiting the hardening tunnel), in addition, low air temperature of the working area (mainly in the area for storing finished products and in the area for manual loading before sending to the hardening chamber); 3 – high or low humidity – at the enterprise for the production of ice cream, high humidity is observed in the area for the preparation of the mixture, where the mixture is pasteurized, homogenized and matures; 4 – increased voltage of electric current, which in the ice cream production shop can be created by a freezer, dosing device, filling machine and other electrical equipment if used improperly; 5 – increased noise level, vibrations, which can also create a freezer, dosing device, filling machine in the ice cream production workshop; 6 – increased level of ultraviolet, infrared radiation, electromagnetic, radioactive and other radiations; 7 – lack of natural or artificial lighting; 8 – sharp edges, roughness burrs on the surface of equipment and tools;
Biological	are divided into pathogenic microorganisms and macroorganisms. The pathogenic microorganisms can enter the human body in the form of: 1 – bacteria; 2 – viruses; 3 – spirochete, i.e. spiral-shaped microbes that cause acute infectious diseases; 4 – mushrooms, i.e. microorganisms that cause fungal diseases. Macroorganisms are divided into vegetable origin and animal origin organisms.

Chemical	are divided into the following groups: 1 – general toxic effects that cause human poisoning – at the ice cream production enterprise human poisoning can be caused by refrigerants (ammonia, some freons) used in refrigeration units; 2 – irritating action, i.e. affecting the mucous membranes of the nose, mouth, eyes – in the ice cream production section this kind of factor can occur with minor ammonia leaks, 3 – sensitizing and allergic action, i.e. changing sensitivity to stimuli; 4 – mutagenic action, i.e. leading to hereditary changes due to the effect on cell genes; 5 – affecting the reproductive ability (reproduction) of a person.
Psychophysiological	are divided into physical loads, characterizing the severity of labor, and neuropsychic loads, characterizing the intensity of labor. Physical loads are subdivided into: 1 – static muscle loads, determined by the magnitude of the required effort and shift time, during which the worker is in a forced position; packers are subject to static loads in the ice cream production section; 2 – dynamic muscle loads, which are estimated by the power expended to perform work, which are most typical for loaders of finished products in the ice cream production workshop; 3 – physical inactivity, i.e. sedentary work; 4 – hypokinesia, i.e. work with little or no physical activity.
Neuro-psyhic	are divided into: 1 – mental stress, estimated by the number of objects, the duration of their observation, this kind of load at ice cream enterprises is typical, for example, for production equipment operators; 2 – voltage of analyzers (vision, hearing), production workers directly responsible for the quality of the product are subject to this kind of stress; 3 – the monotony of labor, in the production workshop for the production of ice cream, production workers are subject to this load, performing operations of the technological process associated with manual labor; 4 – emotional stress.

**Table 8 – Register of Identified Risks for the operator of the ice cream production line**

Name of workplace / subdivision	Number of risk assessment map	Labor function	Hazard code	Name of identified hazards	The final result of the risk assessment	Significance of risk
1	2	3	4	5	6	7
Ice cream production line operator	1	Managing the technological process of ice cream production	1	Physical, biological, chemical, psychophysiological, neuropsychic	Approved for all types of hazard	high

### Conclusion

Hazard identification and risk assessment should be applied to all processes of the enterprise, as it reveals the issues of hazard identification and risk assessment at the level of impact on employees. The main goal of identifying hazards and risks is to prevent incidents of any severity, maintain the health of employees and all involved persons, build a reasoned evidence base when implementing a health and occupational safety system according to ISO 45001. In order to use such data risk registers for specific workplaces are be-

ing developed. In the course of the research, a Register of Identified Hazards for an oil and fat industry enterprise of «Shymkentmay» JSC, a Register of Identified Hazards in the production of meat products of «Karkyn-2030» LLP, a Register of Identified Risks for the operator of the ice cream production line of «Balmuzdak» LLP were developed. Based on the identified hazards, a form of the Occupational Risk Assessment Map to form preventive measures to reduce the negative impact on the life and health of enterprise employees was developed.

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### **Тағам өнеркәсіп кәсіпорындарындағы кәсіптік денсаулығы және қауіпсіздік саласындағы тәуекелдердің деңгейін бағалау үшін қауіптілік тізімін әзірлеу бойынша ұсыныстар**

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**Аңдатпа.** Мақалада қазақстандық тамақ өнеркәсібі кәсіпорындарында қауіпсіз еңбек жағдайларын қамтамасыз ету, жұмысшылардың өмірі мен денсаулығын сақтау үшін қауіп-

тілікті анықтау және кәсіптік тәуекелді бағалау саласындағы ISO 45001 стандартының талаптарын енгізу бойынша зерттеулердің нәтижелері берілген. Әдістеме ретінде Деминг-Шухарт циклі «Жоспарлау-орындау-тексеру-жақсарту» ұсынылған. Қауіптерді анықтау және тәуекелдерді бағалау тәртібін құжаттау қауіптер мен тәуекелдер тізілімдерін әзірлеу арқылы жүзеге асырылатыны анықталды. Мысал ретінде «Шымкентмай» АҚ тағам май шығару саласындағы кәсіпорны үшін сәйкестендірілген қауіптер тізілімі, «Қарқын-2030» ЖШС ет өнімдерін өндіру кезінде сәйкестендірілген қауіптер тізілімі, «Балмұздақ» ЖШС балмұздақ өндіру желісінің операторы үшін сәйкестендірілген қауіптер тізілімі әзірленді. Қауіптерді сәйкестендіру зерттеу объектілері ретінде алынған кәсіпорындардың әрбір қызметкері үшін белгілі бір жұмыс орнының бар қауіптеріне байланысты тәуекелдер картасын қалыптастыруға мүмкіндік береді. Осындай картаның негізінде әрбір тәуекелді бағалау оның маңыздылығын үш санат бойынша белгілей отырып жүргізіледі – жоғары, орташа және төмен. Тәуекелдің белгіленген маңыздылығына байланысты кәсіптік аурулар мен өндірістік жарақаттану қаупін болдырмауға мүмкіндік беретін ескерту шаралары жасалады. Әзірленген құжаттар мен орындалған іс-шаралар осы стандарттың талаптарына сәйкестігін растау кезінде денсаулық пен еңбек қауіпсіздігін сақтау жүйесін мониторингілеу, өлшеу және жақсарту бойынша ISO 45001 стандартының талаптарын орындаудың дәлелі болып табылады.

**Кілт сөздер:** кәсіби денсаулық және еңбек қауіпсіздігі менеджменті жүйесі, талаптар, ISO 45001 стандарты, қауіптер, кәсіптік тәуекелдер, тамақ өнеркәсібі кәсіпорындары, қауіптер мен тәуекелдерді анықтау, Деминг-Шухарт циклі, тізілім, тәуекелдерді бағалау.

#### **Рекомендации по разработке реестра опасностей для оценки уровня рисков в области профессионального здоровья и безопасности на предприятиях пищевой отрасли**

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**Аннотация.** Приведены результаты исследований по выполнению требований стандарта ISO 45001 в области идентификации опасностей и оценке профессиональных рисков для обеспечения безопасных условий труда, сохранения жизни и здоровья работников казахстанских предприятий пищевой отрасли. В качестве методологии предложен цикл Деминга-Шухарта «Планируй-Делай-Проверяй-Улучшай». Установлено, что документирование процедуры идентификации опасностей и оценка рисков проводится через разработку Реестров опасностей и рисков. В качестве примеров разработаны Реестр идентифицированных опасностей для предприятия масложировой отрасли АО «Шымкентмай», Реестр идентифицированных опасностей при производстве мясопродуктов ТОО «Қарқын-2030», Реестр идентифицированных рисков для оператора линии производства мороженого ТОО «Балмұздақ». Идентификация опасностей позволяет сформировать для каждого работника предприятий, которые взяты в качестве объектов исследований, Карту рисков в зависимости от существующих опасностей конкретного рабочего места. На основе такой карты проводится оценка каждого риска с установлением его значимости по трем категориям – высокая, средняя и низкая. В зависимости от установленной значимости риска, разрабатываются предупреждающие мероприятия, которые позволяют предотвращать риски возникновения профессиональных заболеваний и производственного травматизма. Разработанные документы и выполненные мероприятия служат доказательством выполнения требований стандарта ISO 45001 по мониторингу, измерениям и улучшению системы управления охраной здоровья и безопасности труда при подтверждении соответствия требованиям данного стандарта.



**Ключевые слова:** система менеджмента профессионального здоровья и безопасности труда, требования, стандарт ISO 45001, опасности, профессиональные риски, предприятия пищевой отрасли, идентификация опасностей и рисков, цикл Деминга-Шухарта, реестр, оценка рисков.

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