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WESTERN-KAZAKHSTAN BRANCH OF NATIONAL CENTER OF  
INDUSTRIAL HYGIENE AND OCCUPATIONAL DISEASES OF MH  
and SD OF RK

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# FOUNDATIONS OF OCCUPATIONAL MEDICINE

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The teaching guide provides basic information on occupational medicine. There is presented an algorithm and standard actions of specialists in organization and conduction of complex activities, relating to improvement of working conditions and an occupational health conditions of a human. The information about main harmful factors of the production and external environment, the labor process, the nature of their impact on a human and maximum permissible levels of such exposure is presented. Methods and means of protection of a human, creating optimal hygienic conditions in a working area, organizational management practices to comply with health and safety are described. It provides domestic and international legal and regulatory documents on labor protection and improvement of providing assistance of occupational therapists to the population.

The teaching guide is destined for specialists on occupational medicine, occupational health and ergonomics, for safety engineers, psychologists, heads of security and occupational health services, occupational therapists, as well as for students, post-graduate students and training teachers of higher and secondary educational institutions. It is recommended for publication by the educational-methodical council of the university dated 20.06.2012.

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## INTRODUCTION

In accordance with the Development Strategy “Kazakhstan – 2030”, one of the long-term priorities is the health of the citizens of Kazakhstan. Currently, about one and half million people work at industrial organizations, construction, transport and communication organizations, agricultural production, and harmful exposure. Workplace injuries, occupational, production and eco-related diseases cause enormous material damage and claim many lives. Measures to address the problem in the developing world and emerging countries are complicated by the lack of knowledge and information. Investment decisions are often made without taking into account such factors as human health and environment safety and basic principles and postulates of occupational health and industrial toxicology, medical ecology.

One of the main causes of low health indicator of economically active population and unfavorable situation in the field of occupational safety and health is failure to comply with hygiene rules and regulations because of unsatisfactory work organization, violations of labor and production discipline, safety instructions. Performance of the company, state of material and technical base of production, level of technology used and development of scientific, technical, economic and legal institutions protecting the workers have controlling influence on the conditions of work and protection of workers. Integration of Kazakhstan into the world community sets tasks to improve working conditions and safety, harmonize national legislation with international standards, agreements, commitments, in particular within the framework of European Union and International Labour Organization. The task complexity and scale require that the circle of partners involved in ensuring occupational health and promotion of health of workers, included not only the central government, organization of workers and employers, but also local authorities, various ministries, scientific communities, various associations of professional groups of employed persons, association of workers of informal economy.

The above-mentioned occupational medicine issues related to conditions of industrial activity and health of workers attest not only their relevance under current conditions, but also require a search for

application solutions, the results of which would be available in the daily work of engineers and technicians, medical workers, supervisory experts bodies, as well as educators. In this regard, development of appropriate standards and algorithms is quite well-timed in implementation of complex sanitary and engineering measures to improve working conditions and promote health of workers. This practice will make it possible to organize actions of experts, simplify making the management decisions and organize the list of activities and the sequence of their implementation. The importance of these issues, the need for integration of theoretical and applied knowledge in the field of occupational medicine require development of new educational programs and adjustment of existing textbooks and guidelines on occupational health and environmental hygiene.

The thinking about the occupational medicine as an integrated area of preventive medicine has developed based on the achievements of occupational health and physiology, industrial ecology and toxicology, occupational pathology and epidemiology, health and safety. Occupational medicine comprising preventive and clinical components provides comprehensiveness in learning and use of medical-prophylactic and therapeutic and preventive and social-hygienic tools and techniques.

The author of the study guide tried to give a systematic picture of the emerging new scientific discipline such as occupational medicine. The objective of the study guide is to form risk-thinking, common understanding of existing harmful factors of occupational environment and ecological environment, labor process, the nature of impact of negative factors on human, principles for establishing the acceptable levels of impact of chemical, physical and biological factors on human body, causes of occupational, eco- and production-related diseases, prevention methods and means for protection of the person.

The study guide considers concisely and in understandable terms the issues of international cooperation in the field of occupational medicine, regulatory and legislative framework in this area, the issues of safety and health. The author managed to present intelligibly and simply the main sections of workplace hygiene and medical ecology, address the problems of etiology of occupational

diseases, organization of occupational pathology aid to working population. For a better understanding of the subject matter, the study guide has a large number of illustrations and diagrams.

The study guide is for occupational medicine specialists, occupational health and ergonomic experts, safety engineers, psychologists, heads of security and occupational health departments, occupational therapist, as well as for students, post-graduate students and teachers of higher and secondary educational institutions.

## BASIC TERMS AND DEFINITIONS

**Algorithm** is a system of operations for solving a problem based on conducting a sequence of actions; - this is execution of manipulations, actions of selected activities which must be justified and selection of most effective ways and methods to accomplish the goal and objective.

**Certification of workplaces with regard to working conditions** is a system of analysis and evaluation of jobs for recreational activities, familiarization of workers with working conditions, certification of production facilities in order to confirm or cancel the rights of compensation and benefits to employees engaged in heavy work or work under harmful and dangerous working conditions.

**Workplace safety** is a state of working environment which exclude effects of dangerous and harmful factors on workers.

**Safe working conditions** are working conditions in which the impact of harmful and (or) hazardous production factors on workers is excluded or possible levels of impact does not exceed the established limits.

**Harmful working conditions** are characterized by the presence of harmful factors, levels of which exceed health standards and which have an adverse effect on the body of the worker and (or) his offspring.

**Harmful factor of working environment** is the factor of environment and labor process, the impact of which on the worker may cause the occupational disease or other deterioration of health, damage to the health of offspring.

*Harmful factors may include:*

- physical factors;
- chemical factors;
- biological factors;
- labor process factors.

**Time off work** is the period of time in which employee is allowed to take time off from his/her job and use it at his/her discretion.

**Workplace hygiene** is an area of medicine that studies the working activity of the employee and working environment in terms of their impact on the body and develops measures and hygienic standards aimed at improving working conditions and prevention of occupational diseases.

**Hygienic standards of working conditions** are the levels of harmful factors of the working environment which in daily (except weekends) work for 8 hours, but no more than 40 hours a week, during the working life should not cause any diseases or abnormalities in health status detected by modern research methods in the course of work or ulteriorly in course of lifetime of present and future generations. Compliance with hygienic standards does not exclude deterioration of health status in persons with hypersensitivity.

**State examination of working conditions** is evaluation of conformance of the scope of examination to the state regulatory requirements to labor protection.

**Acceptable working conditions** are characterized by such levels of environmental factors and labor process which do not exceed the levels of hygienic standards for workplaces, and possible changes in the functional state of the body are recovered during schedules recreation or by the beginning of the next shift and do not have adverse effects on health of workers and their offspring in the immediate and long-term period. Acceptable working conditions refer to the safe working conditions.

Protection by reducing the time is reducing the harmful effects of unfavorable factors of production environment and labor process on workers through reducing the time of exposure: introduction of intrashift breaks, shorter working hours, increasing the number of vacation days, limiting the length of service in these conditions.

**Health** is a state is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity (preamble of Constitution of the World Health Organization (WHO)).

**The qualification grade (category)** is the level of employee qualification requirements, reflecting the complexity of works performed.

**Qualification** is the level of expertise, skill, and level of fitness for duty in a particular specialty or position defined by category, class, title or other qualification categories.

**Collective agreement** is a legal act in the form of a written agreement between the staff members and employer, regulating social and labor relations in the organization.

**Compensation payments** are the monetary payments associated with the special regime of work and working conditions, job loss, and compensation for workers costs associated with execution of their work duties.

**Occupational medicine** is an integrated area of preventive medicine which is aimed at managing health of worker, and subject of which is scientific substantiation and practical implementation of means and methods of health maintenance and promotion.

**Monitoring the occupational health and safety** is a system of observations of the state of occupational health and safety at production site, as well as the assessment and forecast of the state of occupational safety and health.

**Intensity of work** is characteristic of the labor process which reflects the burden mainly on central nervous system, sense organs, mood of the employee. Factors characterizing the intensity of work are intellectual, sensory, emotional stress, the degree of stress monotony, working regime.

**Deterioration of health** is a physical, mental and social problems associated with the loss, abnormality, disorder of psychological, physiological, anatomical structure and (or) the functions of the human body.

**Standards in the field of occupation health and safety** are ergonomic, sanitary-epidemiological, psychophysiological and other requirements ensuring normal working conditions.

**Labour rating** is determination of the number of man-hours (time) required for employees to complete the work (production of production unit) in specific organizational and technical conditions and establishment of labor standards based on this.

**Compulsory social insurance benefits** is performance by the insurer, and in certain cases established legislation of Kazakhstan, also by the insurant, of its obligations to the insured party upon occurrence of the insured event through insurance payments or other types of benefits stipulated by the legislation of Kazakhstan on specific types of compulsory social insurance.

**Dangerous (extreme) conditions of work** are working conditions characterized by levels of production factors the effects of which during the work shift (or part thereof) create a threat to life, a high risk of severe acute occupational injuries.

**Working environment hazard** is a factor of environment and labor process which may be the cause of acute illness or sudden sharp deterioration of health, death. Depending on the quantitative characteristics and duration of effect, some harmful factors of working environment can be hazardous.

**Optimal working conditions** are the conditions under which health of the employee is preserved and prerequisites for maintaining a high level of efficiency are created.

**Occupational safety** is systems for ensuring safety of employees' life and health during labour activity.

**Fire safety** is the state of protection of the person, property, society and the state against the fire.

**Permanent workplace** is the place where the worker spends the most of his working time (more than 50%, or more than 2 hours continuously). If the work is carried out at various points in the work area, permanent jobs are considered to be the entire work area.

**Operating activities** is a series of actions performed by the workers using the instruments of labor required for conversion of resources into finished products, including the production and processing of various types of raw materials, construction, and provision of various services.

**Industrial health** is a system of organizational measures and technical means to prevent or reduce the impact of harmful factors that arise in the work area during working activities on the workers.

**Industrial injury** is damage to the health of the worker, resulting from the performance of his job duties and leading to the loss of ability to work.

**Production equipment** is machines, equipment, devices, apparatus, instruments and other technical equipment required for production.

**Production-related incidence of disease** is incidence (standardized by age) of common diseases of different ethnology (mainly polygenic) which tends to increase in proportion to increase in length of service in adverse working conditions and exceeds the incidence in the occupational groups that do not contact with harmful factors.

**Occupational incidence of disease** is an indicator of the number of newly diagnosed patients with occupational diseases and poisoning during the year calculated for 100, 1000, 10 000, 100 000 workers exposed to harmful factors of production environment and labor process.

**Occupational diseases** are diseases caused by the impact of unfavorable factors of production environment and labor process.

**Professional risk** is the ratio of probability of deterioration (damage) of health, taking into account the severity of consequences resulting from the adverse effects of factors of production environment and labor process. Assessment of professional risk is carried out taking into account the level of exposure of the last indicators of the health of workers and loss of ability to work.

Profession is a kind of employment, activities performed by the person who have a set of special skills and knowledge obtained through education, training. The main profession shall be the work performed according to the highest qualification or work performed over a long period of time.

**Employer** is a private or legal person who has an employment relationship with the employee.

**Ability to work** is the human condition, determined by possibilities of physiological and mental functions of the body which characterizes employee's ability to perform a specified amount of work of a given quality within a required time interval.

**Work area** is a space limited in height of 2 m above the floor level or platform level on which the place of permanent or non-permanent (temporary) work is located.

**Work place** is a place where the worker must stay or where he/she should arrive in connection with his work, and which is directly or indirectly under the control of the employer.

**Overtime work** is a work performed by the employee on the initiative of the employer outside the fixed normal working hours.

**Certificate of conformity of the organization of occupational safety works** is a document certifying the conformity of the occupational safety works carried out by the employer to state requirements to occupational safety.

**Shift work** is a work in two or three or four shifts throughout the day.

**Social partnership** is the system of relationships between employees, employers, public authorities, aimed at ensuring the coordination of their interests in regulation of labor relations and other relations directly related to them.

**Specialty** is a kind of professional activities, improved by special training; a certain area of work and knowledge.

**Personal protective equipment** is means intended to protect workers from exposure to harmful and (or) hazardous production factors, including special clothing.

**Equipment for the personal and collective protection of employees** is the technical means used to prevent or reduce exposure of workers to harmful and (or) hazardous production factors, as well as to protect against contamination.

**Collective protection equipment** is technical means intended for simultaneous protection of two or more employees from the impact of harmful and (or) hazardous production factors.

**Standards in occupational medicine** are the list of all kinds of manipulations and actions, including the legal, organizational and technical, sanitary and hygienic, medical and preventive, rehabilitation and other measures aimed at ensuring the health of workers during performance of work.

**The insured event** is an event which represents the occurrence of social and insurance risk, upon which the obligation to conduct support under compulsory social insurance arises for the insurer, and in certain cases specified by the legislation of Kazakhstan, for insurant too.

**Injury prevention** is conformance of places of work to occupational safety requirements which excludes injuring of employees who work in the conditions established by the normative legal regulations on occupational safety.

**Occupational safety requirements** are the state regulatory requirements for occupational safety and occupational safety requirements established by the occupational safety rules and regulations.

**The labor** is human activity aimed at creating material, spiritual and other values necessary for life and meeting human and social needs.

**The employment contract** is a written agreement between the employee and the employer, whereby the employee undertakes to perform using own efforts a specific job (labor function), to comply with labor regulations, and the employer shall give the employee work according to a given employment function, provide the working conditions specified by the Labor Code of the RK, laws and other normative legal acts of the Republic of Kazakhstan.

**Employment relationship** is the relationship between the employee and the employer, arising for the purposes of execution of rights and duties stipulated by the Labor Legislation of Kazakhstan, employment, collective agreements.

**Employability** is the human condition in which a set of physical, mental and emotional capabilities enables the employee to perform the work of a certain amount and quality.

**Heavy works** are works reflecting mainly the load on locomotor system and functional systems, the execution of which is associated with involvement of more than 2/3 of human muscle; - Types of employee's activities associated with lifting or moving heavy loads by hand or other physical activities with an energy consumption more than 250 kcal/h.

**The heaviness of labor** is characteristic of the labor process, reflecting the primary load on the locomotor system and functional systems (cardiovascular, respiratory, etc.) of the body, ensuring its activities. The heaviness of labor is characterized by dynamic load, weight of lifted and moved good, the total number of stereotyped movements, the magnitude of the static load, working posture, depth and frequency of body tilt, movement in space.

**Working conditions** are combination of factors of labour process and working environment in which the person carries out activities.

**Exposure** is quantitative characteristic of the intensity and duration of the harmful factor.

## THE LIST OF ABBREVIATIONS

UN - United Nations Organization.  
ILO - International Labour Organization.  
WHO - World Health Organization.  
ICIT - International Commission on Occupational Health.  
ISO-9000 – Modern production management system standard.  
ISO 14000 - Modern production and environmental protection management system standard.  
OSH-MS – Standard of safety and occupational medicine management system in enterprises.  
MHSD - Ministry of Health and Social Development.  
MES - Ministry of Education and Science.  
HR - Hygienic regulations.  
MPC - Maximum permissible concentration.  
MPL - Maximum permissible level.  
MPE - Maximum permissible emissions.  
SRLI - Temporary health-based exposure limit of chemical substance in the air.  
PRQ- Permissible residual quantity  
EC - Emissions of chemicals  
IAP - Index of air pollution.  
WPI - Water Pollution Index  
SPZ - Sanitary Protection Zone  
DL - The dust load.  
PR - Professional risk  
MTD - morbidity with temporary disability.  
HI - Cumulative risk.  
HQ - Hazard coefficient  
MRLs - Minimum level of risk  
RfC - Reference concentration  
RfD - Reference Dose  
Zc - The total content of elements  
Zcarc - The total content of carcinogens

## Chapter 1 THE INTERNATIONAL COOPERATION IN THE FIELD OF OCCUPATIONAL LABOR

The globalization problems of today's world, the economic crisis ever more pressingly put the issues of occupational safety and health on the agenda. It is commonly known that there is nothing more valuable and obvious than the right to life. More than one third of adult life, each person spends in the workplace, contributing to the development of society. The right to the highest attainable standards of health is generally accepted and without these standards, person can not work and make positive contribution to the society and achieve his/her own well-being.

The above principles governing the basic human rights are enshrined in the fundamental documents of the OSCE (OSCE - Organization for Security and Cooperation in Europe) which was chaired by Kazakhstan. During chairmanship, the Kazakhstan declared that human dimension is a key topic on the agenda of the Organization and the chairmanship.

Working conditions and health status of the population in the Commonwealth of Independent States, including Kazakhstan is a source of major concern of the last two decades. More than nine million occupational accidents with a fatal outcome are registered annually in the countries of region. Life expectancy of the population, especially among men, has fallen sharply. Practice of underreporting about not only occupational injuries and accidents, but also actual data on occupational and work-related diseases assumed irresistible proportions. This practice is particularly used by small and medium enterprises, as well as those enterprises which operate in the informal economy. At the same time there are also positive trends in the region. The majority of the CIS countries have assessed their systems of labor protection and developed a program to improve them. There is a growing awareness that occupational safety is a good business, and occupational medicine plays a crucial role in maintaining the health of workers [1-4].

According to the estimates of International Labour Organization (ILO), in the world, more than 2.2 million men and women are dying annually as a result of accidents in the workplace. In addition, about



337 million industrial accidents with non-fatal outcome are registered. Industrial accidents and occupational diseases result in loss of four per cent of global gross domestic product, which is by 20 times exceeds the support amount allocated by all states for development. Besides the economic aspects of the problem, its moral dimension should also be emphasized: human losses associated with poor working conditions shall not be reconciled to [5-7].

Great importance in improving the working conditions and protection of the health of the working population is attached to **Occupational medicine**, which was defined by the World Health Organization (WHO) and the International Labour Organization (ILO).

ILO/WHO Joint Committee on Occupational Medicine adopted the definition of “occupational medicine” at its 1st session (1950) and revised it at the 12th session (1995). The aim of Occupational Medicine is to strengthen and maintain the highest degree of physical, mental and social well-being of workers in all occupations; prevention of deterioration of health of workers caused by their working conditions; protect workers in their working conditions from risks resulting from factors adverse to health; create and preserve jobs in the working environment adapted to their physiological and psychological capabilities; and as a result - to adapt the work to the workers and each worker to his or her work. There are three different main goals in occupational medicine: 1) to preserve and promote the health and ability to work of workers, 2) to improve the working environment and work to ensure that they are conducive to safety and health, 3) to organize work and production standards for promotion of health and safety in place of work, creating at the same time a positive social climate and well-coordinated work that can increase productivity. The concept of culture of production in this context reflects the core values system adopted in the enterprise. Such culture consists in practice of personnel policy management system, the principles of participation, training methods and quality management at the enterprise.

Intergovernmental (UN and its specialized agencies - ILO, WHO, FAO, UNESCO, etc.) and non-governmental agencies - ICIT (International Commission on Occupational Health), IASS (International Association of Social Insurance) are the foundation for

international cooperation in the field of occupational medicine. In addition to the above structures, EEC, EurAsEC, OECD (Organization for Economic Cooperation and Development) also participate in regulation of issues in the field of occupational medicine. The ILO Regulations, ILO Conventions and Recommendations dealing with occupational safety and health, the Global Strategy for Occupational Health and the ILO program “Decent work” set the fundamental rights to the highest standards of occupational safety and health, working conditions and protecting the health of the working population. The right to health is set forth in the Regulations of the World Health Organization (WHO), in Alma-Ata Declaration on Primary Health Care (1978) in the WHO Global Strategy on Occupational Medicine and the WHO Global Plan of Action for 2008-2017.

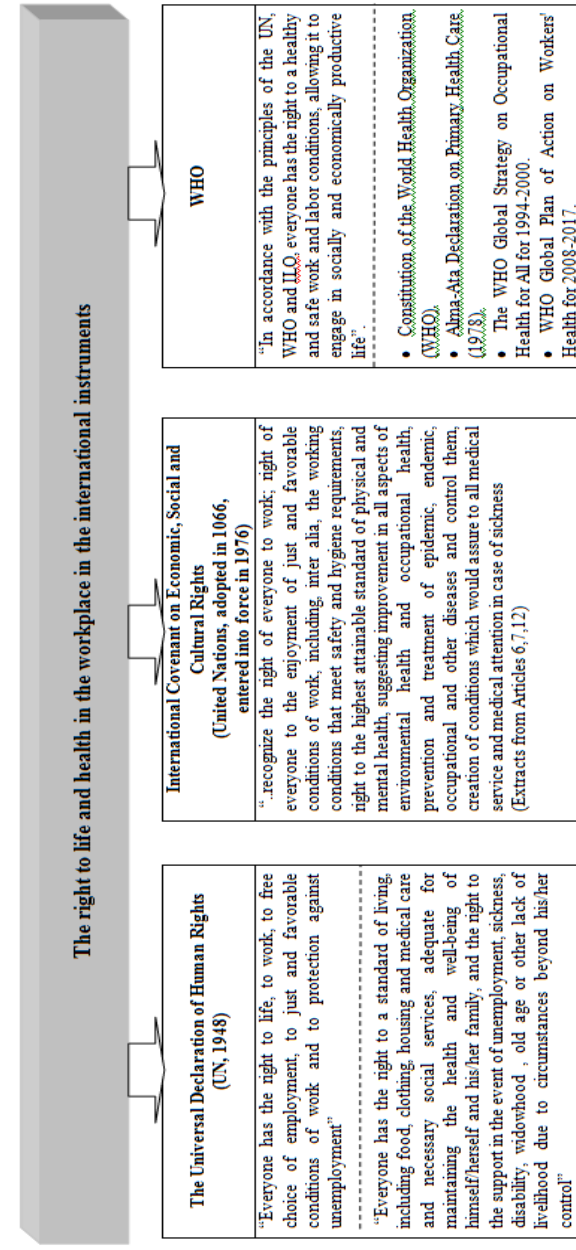
In 1996, the World Health Assembly adopted the WHO Global Strategy “Occupational Medicine for all” with plan of actions for coming years, including 10 strategic objectives:

- 1) Strengthening the international and national policy on occupational medicine and development of the required policy instruments;
- 2) Creating a healthy working environment;
- 3) Development of healthy work practices and health promotion at work;
- 4) Strengthening the health services;
- 5) Establishment of support services for occupational medicine;
- 6) Development of occupational health standards based on scientific risk assessment;
- 7) Personnel training for Occupational medicine;
- 8) Establishment of registration and data collection systems, development of information services for experts, effective data transmission and improving public awareness through public information;
- 9) Strengthening the research;
- 10) Organization of cooperation in occupational medicine and other structures and services.

Analysis of activities of occupational medicine services conducted by the WHO European Regional Office in the European countries has

allowed formulating practical principles in the field of occupational medicine:

- Protection of workers' health from hazards at work (protection and prevention principles);
- The adaptation of the work and the working environment to the capabilities of workers (the adaptation principle);
- Improving the physical, mental and social well-being of workers (the principle of health promotion);
- Reducing the impact of occupational hazards, accidents and injuries, occupational and profession-related diseases (the principle of treatment and rehabilitation);
- Provision of general health care (medical and preventive) to workers and their families in the workplace or near it (the principle of common primary care).



**Figure No.1**

**International WHO programs and institutions  
in the field of occupational medicine**

<b>UNEP</b>	<i>United Nations Environment Programme, provides technical support and cooperation of all countries in the field of environmental monitoring, education and training of personnel on occupational medicine and conducts the International Registration of Potentially Toxic Chemicals (IRPTC).</i>
<b>GEENET</b>	<i>Program for Global epidemiological assessment of the state of the environment, which also covers the organization and specialists from different countries involved in the epidemiology of occupational and environmental medicine.</i>
<b>IPCS</b>	<i>International Programme on Chemical Safety.</i>
<b>IOMC</b>	<i>Programme for guarantee of safe handling of chemicals.</i>
<b>OECD</b>	<i>WHO Independent Institute dealing with industrial ecology and ecotoxicology.</i>
<b>IARC</b>	<i>WHO Independent Institute dealing with issues of epidemiology, treatment and prevention of malignant tumors.</i>

<b>ICON</b>	<i>International Commission on Occupational Health</i>
<b>NDPHS</b>	<i>Regional Organization "Northern Dimension" on public health and social well being</i>
<b>BSN</b>	<i>The network structure for labor protection of the Baltic Sea countries.</i>
<b>CIS</b>	<i>Executive Committee of the Commonwealth of Independent States.</i>
<b>UNCTAD</b>	<i>UN Trade and Development Conference, relating, in particular, to International transfer of goods, services in the field of occupational medicine.</i>
<b>HESME</b>	<i>The health, environment, safety and social potential management system at enterprises which allows controlling not only the health of the workers, but also their families, taking into account the environment, lifestyle, industrial and social health factors, as well as the quality of health care</i>

**Figure No.2**

The considerable scope of knowledge is accumulated in the international labor standards, codes of practice and guidelines that have been developed by the International Labour Organization over the past 90 years and which set forth the fundamental principles and rights in the field of occupational safety and health. Together, they represent a kind of international labor law which establishes minimum standards for the protection of employees' rights in this area [8-11].

International Labour Organization (ILO), founded in 1919, became the first specialized agency in the system of newly established United Nations (UN) in 1946. ILO international labor standards are adopted at the International Labour Conference which is held annually. The ILO is based on a three-way partnership, involving representatives of governments, employers and employees. The ILO secretariat, headquarters, research center and publishing house are located in the International Labour Office in Geneva. Management and implementation of ILO strategic goals and objectives is carried out through the regional and subregional offices located in more than 50 countries around the world. ILO Subregional Office for Eastern Europe and Central Asia is located in Moscow.

By 2000, the ILO has adopted 183 Conventions, 196 recommendations, with working conditions considered in the 75 conventions (48 conventions - on general provisions and 27 Conventions - on occupational safety and occupational medicine).

General Conventions and Recommendations concern the issues of regulation of working time, the minimum age for work, night work and overtime work, medical examination of employees, maternity protection and family responsibilities. Also these conventions address issues relating to non-discrimination of employees for various reasons, protection of employees from unfair dismissal and compensation in case of occupational diseases, injuries [12-16].

The most important conventions on occupational safety and occupational medicine are conventions dedicated to occupational safety and health, formation of occupational health services, protection of the working population from occupational risk caused by air pollution and exposure to physical factors. Importance of conventions on occupational safety and occupational medicine is quite beyond the legal obligations that arise as a result of their ratification. These Conventions form a set of international production standards, and thus, present authoritative guidance on occupational safety and preservation of employee's health for national authorities, employers, employees and their organizations. Based on the ILO Guidelines on HSE management systems (ILO-HSE MS 2001), 11 CIS countries approved a new standard (GOST 12.03.230-2007) for HSE MS which is identical to the International Standard set out in the Guidance (ILO-HSE MS 2001).

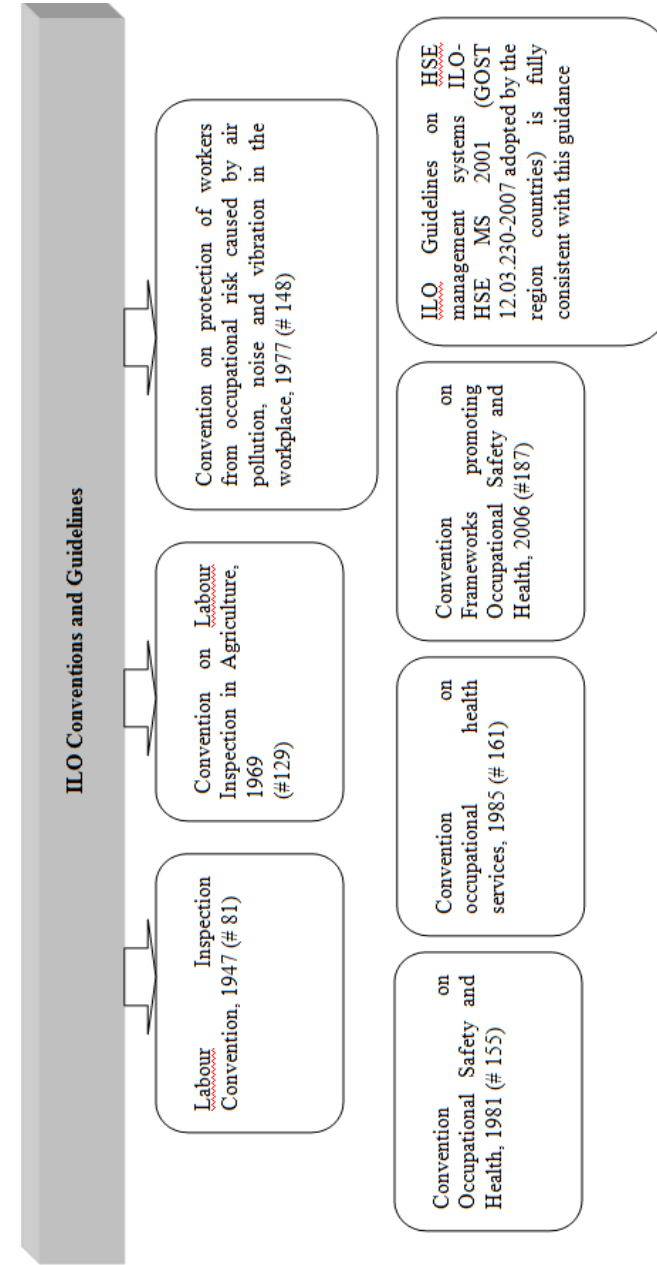


Figure # 3

WHO and ILO support integration and occupational medicine in the modern production management system through appropriate standards. According to ISO-9000 Standard, the companies are required to document their activities in 20 areas. At the same time, the resultant of this activity must be in accordance with the production management system, requirements of standards and certification of enterprise of accounting firm with international name. Introduction of ISO 9000 standards at the enterprise stimulates introduction of automation and ensures production of quality products. ISO-14000 standard provides the improvement of production and environment protection management system. The mechanism of its implementation at enterprises associated with the introduction of registration and periodic audits is similar to those of ISO-9000. The ILO is currently developing guidance on occupational safety and medicine management system at enterprises - OSH-MS.

World federation of national standards bodies - ISO comprises more than 120 member countries. Its task is associated with development of standards to facilitate the exchange of goods and services, development of cooperation in intellectual, scientific, technological and economic fields. ISO covers all areas of standardization, and the International Electrotechnical Commission (IES) deals only with standardization in the electrical and electronic products. The International Organization for Standardization ISO includes 185 technical committees, 600 subcommittees and 2000 working groups. More than 100 000 experts worldwide, including in Kazakhstan, support its activities. Technical committees are formed in the field of acoustics, mechanical vibration, noise, air quality, ergonomics, safety of machinery and equipment, welding, certain types of production and construction etc.

In achieving the goals and objectives of occupational medicine, significant importance is attached to the International Commission on Occupational Health (ICIT). ICIT consists of 26 scientific committees and 4 scientific working groups that consider the following issues: injury prevention, aging and work, agriculture, cardiology, chemical industry (Medichem), computerization of occupational and environmental medicine, construction and developing countries, education and training, epidemiology in occupational medicine, fiber, health care providers, study of health

The right to life and health in the workplace in the ILO international instruments

<p><b>ILO Constitution, 1919</b></p> <p>“... Protection of workers against sickness, occupational disease and accidents at work”. (Preamble)</p>	<p><b>Declaration of Philadelphia, 1944</b> (Declaration of the aims and objectives of the International Labour Organization)</p> <p>The principles which should inspire the policy of the Organization, “necessary protection of life and health of workers in all occupations; extension of social security system in order to provide a basic income to all in need for such protection and comprehensive medical care” (Extract from Part III)</p>	<p><b>ILO Declaration on Social Justice for a Fair Globalization, 2008</b></p> <p>“... Employment, social protection, social dialogue and rights in the world of work ... a healthy and safe working conditions; about politics in the sphere of labor remuneration, working hours and other working conditions; ... about extension of social support and distributing it to all”</p>	<p><b>Seoul Declaration on Labour Protection, 2008</b> (World Congress and Summit on Occupational Safety)</p> <p>“Pointing out that the right to safe and healthy working environment should be recognized as one of fundamental human rights, and that the globalization of economy must track closely with preventive measures aimed at improving safety and health of all workers”</p>
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The fundamental principles of occupational safety and health contained in the basic international labor standards












Figure # 4













services, industrial hygiene, musculoskeletal disorder, neurotoxicology and psychophysiology, nursing auxiliary in occupational medicine, occupational toxicology, organic dust, pesticides, radiation and work, occupational health services in small enterprises, shift work, metal toxicology, work-related respiratory disorders, vibration and noise, occupational and environmental dermatosis, disability and labor, reproductive hazards in the workplace, thermal factors.

Integration of the Republic of Kazakhstan in the global labor market, entry into the common customs and economic union with Russia and Belarus (from January 2015, formation of the Eurasian Economic Union and the entry of the republic into the WTO) predetermined the need for ratification of international instruments on occupational safety and health of the working population.

### ILO Conventions and international agreements ratified by the Republic of Kazakhstan

	ILO Convention # 81 on labor inspection in industry and commerce was ratified by the Law dated 07.05.2001, # 194-II (Geneva, 19.06-11.07.1947).
	ILO Convention # 155 on Occupational Safety and Health was ratified by law dated 13.06.96, # 7-1 (Geneva, 03.06.1981).
	The Agreement on cooperation in the field of occupational safety and health was ratified by the Decree of the President of RK dated 04.09.95, # 2451 (Moscow, 09.12.1994).
	The Agreement on procedure for investigating accidents was ratified by the Decree of the President of RK dated 25.08.95, # 2423 (Moscow 09.12.1994).

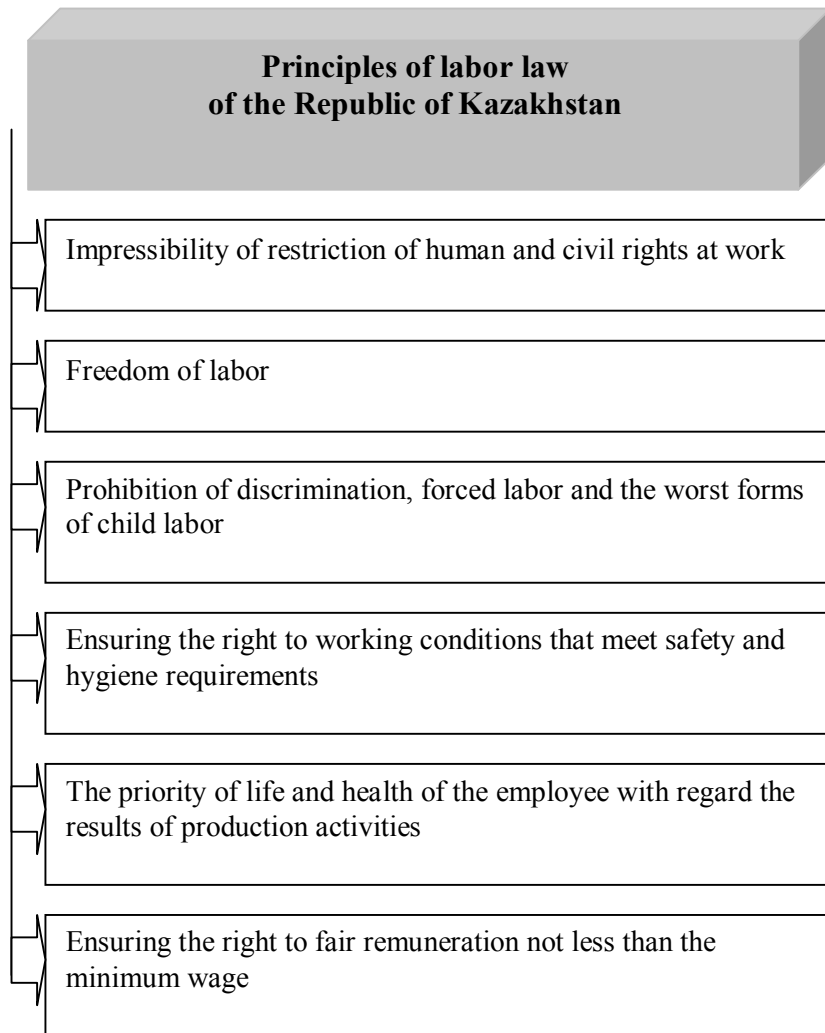
	The Agreement on mutual recognition of rights to compensation was ratified by the Decree of the President of the RK dated 25.05.95, # 2303 (Moscow, 09.09.1994).
	ILO Convention # 148 on protection of employee from occupational risk caused by air pollution, noise and vibration in the workplace was ratified by the Law of RK dated 26.06.96, # 10-1
	ILO Convention # 129 on labor inspection in agriculture was ratified by Law dated 07.07.2001, # 195-II.
	Convention on Nuclear Safety was ratified by the Law dated 03.02.2010, # 245-IV the (Vienna, 17.06.1994)
	Joint Convention on Safety of Spent Fuel Management and on the Safety of Radioactive Waste was ratified by the Law dated 03.02.2010, # 246-IV (Vienna, 05.09.1997)
	The Agreement on adoption of Uniform Conditions for Periodical Technical Inspections of Wheeled Vehicles and the Reciprocal Recognition of such Inspections was ratified by the Law dated 30.06.2010# 299-IV (Vienna, 13.11.1997)
	The Agreement on adoption of uniform technical prescriptions for wheeled vehicles, equipment and parts which can be fitted and/or used on wheeled vehicles, and on conditions for reciprocal recognition of approvals issued on the basis of these prescriptions was ratified by the Law dated 30.06.2010 # 301-IV (Geneva, 20.03.1958)
	The Customs Union Agreement on Sanitary Measures was ratified by the Law of RK dated 30.06.2010 #302-IV (St. Petersburg, 11.12.2009)
	The Customs Union Agreement on Plant Quarantine was ratified by the Law of RK dated 30.06.2010 # 304-IV (St. Petersburg, 11.12.2009)
	The Customs Union Agreement on veterinary and sanitary measures was ratified by the Law of RK dated 30.06.2010 # 305-IV (St. Petersburg, 11.12.2009)
	The Convention # 162 "On safety in the use of asbestos" was ratified Law of the Republic of Kazakhstan dated 17.01.2011, # 388-IV

	The Convention # 182 “On the Prohibition and Immediate Action for Elimination of Worst Forms of Child Labour” was ratified by the Law dated 26.12.2002 # 367
	Convention # 167 “On Occupational Safety and Health in Construction” was ratified by the Law dated 19.06.2007 # 263
	The Convention # 155 “On occupational safety and health and the working environment” was ratified by the Law dated 13.06.1996, # 7-1.
	The Convention # 148 “On protection of workers from occupational risk caused by air pollution, noise and vibration in the workplace” was ratified by Law of the Republic of Kazakhstan dated 26.06.1996, # 10-1
	The Convention # 138 “On the minimum age for admission to employment” was ratified by the Law dated 14.12.2000 # 116-P
	The Convention # 129 “On labor inspection in agriculture” was ratified by the Law of the Republic of Kazakhstan dated 07.05.2001, # 195.
	The Convention # 105 “On the Abolition of Forced Labour” was ratified by the Law dated 14.12.2000 # 117-P
	The Convention # 81 “On labor inspection in industry and commerce” was ratified by the Law dated 07.05.2001, # 194
	The Convention # 29 “On forced or compulsory labor” was ratified by the Law dated 14.12.2000 # 120-P
	The Convention # 87 “On Freedom of association and protection of the Right to Organization” was ratified by the Law dated 30.12.1999 # 29-P
	The Convention “On Early Notification of a Nuclear Accident” was ratified by the Law of the Republic of Kazakhstan dated 03.02.2010, # 243-IV ZRK
	The Convention “On Assistance in the Case of a Nuclear Accident or Radiological Emergency” was ratified by the Law dated 03.02.2010, # 244-IV ZRK

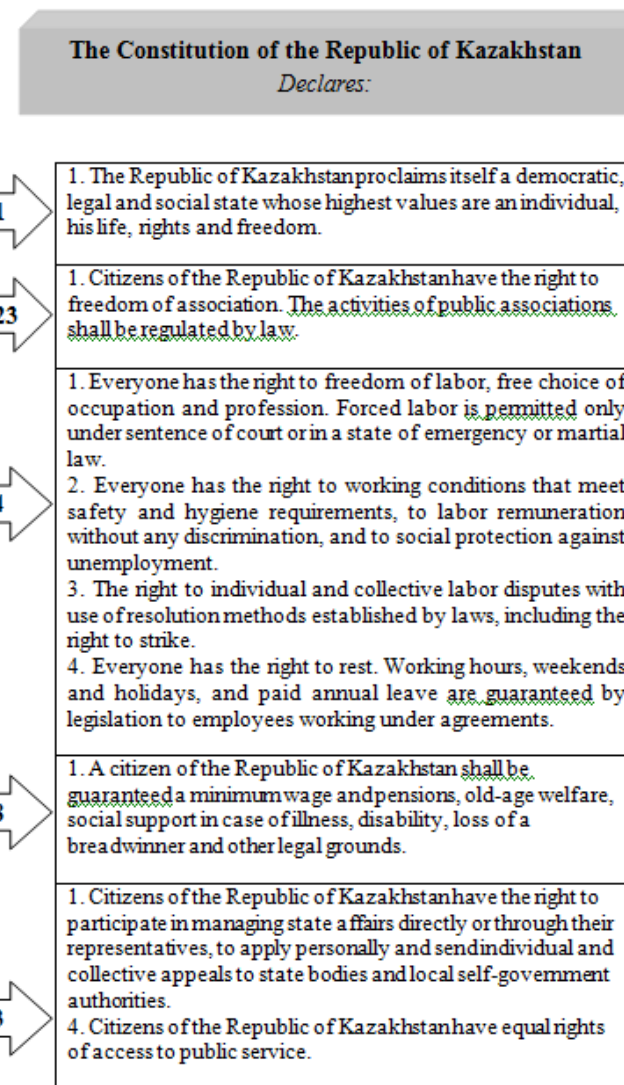
**Figure No.5**

There is a group of basic safety and health standards, included in the system of occupational safety standards developed in accordance with international standards, such as the State Standard of the Republic of Kazakhstan “*Occupational health and safety management systems. Requirements*” STRK 1348-2005 (OHSAS 18001: 1999, MOD).

By virtue of the norms of international law recognized by Kazakhstan, all international treaties (Conventions, Agreements) to which the Republic of Kazakhstan is the party, take precedence over the laws of Kazakhstan [17-18]. This means that in case of conflict between an international treaty and legal act of Kazakhstan, the norm of international treaty shall apply. Labour legislation of the Republic of Kazakhstan is based on the Constitution of the Republic of Kazakhstan and consists of the Labor Code of the Republic of Kazakhstan dated 15.05.2007 # 251-III, laws of the Republic of Kazakhstan and other regulatory acts of the Republic of Kazakhstan



**Figure No.6**



**Figure No. 7**



**Chapter 2**  
**LEGAL AND LEGISLATIVE FRAMEWORK**  
**IN THE FIELD OF OCCUPATIONAL MEDICINE**

Creation of healthy and safe working conditions at production site is provided by numerous legal, technical, economic and organizational measures. Legal framework for management, supervision and control of working conditions is formed by a diverse and well-developed system of legislative, regulatory and legal acts regulating various issues of occupational medicine at production site.

All issues related to the organization of work at enterprises and organizations are determined by the relevant laws and regulations.

**The legislation** is a body of laws of the country in any field of law, in particular in the field of health and safety.

**The regulatory act** on occupational health and safety is an act that establishes the right of workers to health and safety at work, adopted or approved by the legislative authority.

**Statutory instrument on occupational health and safety** is an instrument establishing a set of legal, organizational and technical, sanitary, medical and preventive requirements aimed at ensuring security, preservation of health and performance of employees at work, approved by the competent authority.

The fundamental regulatory acts regulating the issues of occupational health and safety in the Republic of Kazakhstan are the Constitution of the Republic of Kazakhstan and the Labour Code of the Republic of Kazakhstan.

The statutory instruments on occupational health and safety include also the following:

- standards of System of occupational safety standards (OSS) to be approved: the state standards (GOST) – by CIS Interstate Council for standardization, metrology and certification; industry standards (OST) – by the relevant Ministries, other central executive authorities; enterprise standards (EST) – by enterprises; technical regulations – by Resolution of the Government of the RK;

- sanitary rules, norms, health standards, guidelines, ergonomic, physiological and other requirements, approved by the Ministry of Health of the Republic of Kazakhstan and other agencies;

- inter-industry rules and instructions on occupational health and safety, approved by the central executive authority and the relevant supervisory and regulatory body in coordination with the Ministry of Labor and Social Protection of the Republic of Kazakhstan.

- Industry-specific rules and regulations on occupational safety, approved by the Ministry of Labor and Social Protection of the Republic of Kazakhstan in coordination with other ministries and departments.

Table No. 1. The legislative and other statutory instruments in occupational medicine (as of January 1, 2015).

#	Status (Code, Law, TR, SanPin, SNIIP, ILSR (Interindustry labor safety rules, ISLSR (Industry – specific labor safety rules, PS, SI, SS, RP), document number, approval date, authority	Name of document (full)
1	2	3
1.	Code of the RK # 251-III, 15.05.2007	Labor Code of the Republic of Kazakhstan
2.	Code of the RK # 409-I, 01.07.1999	The Civil Code of the Republic of Kazakhstan
3.	Law of the RK # 305-3, 21.07.2007	On safety of machinery and equipment
4.	Law of the RK # 302-3, 21.07.2007	On safety of Chemical Products
5.	Law of the RK # 528-II, 28.02.2004	On health and safety
6.	Law of the RK # 361-II, 04.12.2002	On sanitary-epidemiological welfare of population
7.	Standard provision dated 28.10.2011 # 1219 PP RK	On approval of standard provisions on health and safety service in the organization

1	2	3
8.	TR # 1634 dated 29.12.2011 PP RK	The requirements for harmful (pollutants) emissions by vehicles put into circulation in the territory of the Republic of Kazakhstan
9.	TR # 1219 dated 19.11.2010 PP RK	Requirements for safety of toxic and highly toxic substances
10	TR # 1202 dated 17.11.2010 PP RK	Requirements for safety of buildings and structures, building materials and products
11	TR # 812, 09.08.2010, PP RK	Electromagnetic compatibility
12	TR # 731, 17.07.2010, PP RK	Requirements for safety of coals and production processes of their production, processing, storage and transportation
13	TR # 805, 06.08.2010, PP RK	General requirements for safety, functional and technical requirements for telecommunication equipment during investigation operations
14	TR # 794, 04.08.2010, PP RK	Requirements for safety of rail transport and related infrastructure
15	TR # 769, 31.07.2010, PP RK	Requirements for safety of signaling, blocking, communication and computerization of traffic
16	TR # 768, 30.07.2010, PP RK	On approval of technical regulation "Nuclear and Radiation Safety"
17	TR # 684, 01.07.2010, PP RK	Nuclear and radiation safety of nuclear research facilities
18	TR # 683, 01.07.2010, PP RK	Nuclear and radiation safety of nuclear power stations
19	TR # 634, 23.06.2010, PP RK	Requirements for safety of gasoline additives
20	TR # 588, 15.06.2010, PP RK	Requirements for safety of processing of agricultural raw materials. Crop products.
21	TR # 563, 12.06.2010, PP RK	Requirements for safety of lubricants and special liquids for automotive vehicles
22	TR # 529, 07.06.2010, III PK	Requirements for safety of medical equipment and medical products
23	TR # 588, 15.06.2010, III PK	Requirements for safety of the agricultural raw materials processing equipment. Crop Production

1	2	3
24	TR # 491, 28.05.2010, PP RK	Requirements for safety of fertilizers
25	TR # 172, 03.03.2010, PP RK	Requirements for safety of lifts
26	TR # 153, 01.03.2010, PP RK	Requirements for safety of gasoline, diesel fuel, fuel oil
27	TR # 153, 01.03.2010, PP RK	Requirements for safety of gasoline, diesel fuel, fuel oil
28	TR # 47, 30.01.2010, PP RK	Requirements for biological safety of implants
29	TR # 36, 29.01.2010, PP RK	Requirements for safety of pipelines of flammable, toxic, liquefied gas
30	TR # 36, 29.01.2010, PP RK	Requirements for safety of pipelines of flammable, toxic, liquefied gas
31	TR # 805, 06.08.2010, PP RK	General requirements for safety, functional, and technical requirements for telecommunication equipment during investigation operations
32	TR # 712, 14.07.2010 PP RK	Requirements for safety of drugs
33	TR # 969, 21.09.2010 PP RK	The requirements for safety of food products derived from genetically modified (transgenic) plants and animals
34	TR # 925, 10.09.2010 PP RK	Requirements for emissions into the environment during the production of aluminum by electrolysis
35	TR # 792, 04.08.2010 PP RK	Requirements for safety of carriage of passengers, transportation of baggage, cargo, cargo-luggage and mail by railway transport
36	TR # 2231, 29.12.2009 PP RK	Requirements for safety of oil and gas, drilling, geological survey and geophysical equipment
37	TR # 2231, 29.12.2009, PP RK	Requirements for safety of oil and gas, drilling, geological survey and geophysical equipment
38	TR # 2207, 25.12.2009, PP RK	Requirements for safety of underground mining of ore, non-ore and placer mines
39	TR # 2157, 21.12.2009, PP RK	Requirements for safety of equipment operated under pressure

1	2	3
40	TR # 2160, 21.12.2009, PP RK	Requirements for safety of stationary compressor refrigeration units
41	TR # 2126, 15.12.2009, PP RK	Requirements for safety of hot water and steam boilers
42	TR # 2117, 15.12.2009, PP RK	Requirements for safety of materials handling equipment
43	TR # 2125, 15.12.2009, PP RK	Requirements for safety of hot water and steam boilers
44	TR # 1939, 26.11.2009, PP RK	Requirements for safety of open-cast mining of ore, non-ore and placer mines
45	TR # 1940, 26.11.2009, PP RK	Requirements for safety of mine hoisting installations
46	TR # 515, 29.05.2008, PP RK	Requirements for safety of pesticides (insecticides)
47	TR # 1398, 29.12.2007, PP RK	Requirements for safety of paints and solvents
48	Rules... The order of the MH SD of the RK # 697, 28.08.2015	On approval of rules for provision of milk, healthy and dietary meal, special clothes, special footwear and other personal protective equipment to the employees, provision of collective protection, sanitary and amenity facilities and devices at the employer's expense
49	Rules... № 437, 22.04.2011 PPRK	On approval of the Rules for organization of working time and rest for crew members of civil aircraft and experimental aircraft of the Republic of Kazakhstan
50	Regulation # 06-3/488 dated 26.08.2011 the Order of the Minister of agriculture of the RK	On approval of regulations of the state service "The state registration of pesticides (toxic chemicals)"

1	2	3
51	ILSR № 157, 20.02.2013 PP RK	On Amendments to the RK Government Decree dated July 20, 2010 # 745 "On approval of the register of public services provided to individuals and legal persons" and dated May 23, 2011 # 560 "On approval of the standard of the state service "State registration and re-registration of child nutrition products, food and food supplements, genetically modified objects, dyes, disinfectants, disinfection and deratization means, materials and products contacting with water and food, chemicals, certain types of products and substances that have a harmful effect on human health "
52	ILSR The Order of acting Minister for investments and development of the RK # 667, 28.05.2015	On approval of the Regulations of the state service "Registration and accounting of chemical products"
53	ILSR The Order of acting Minister for investments and development of the RK # 694, 16.06.2015	On approval of Rules of registration and accounting of chemical products
54	ILSR # 851, 27.09.2007, PP RK	Rules for organization and carrying out the state control in the field of occupational safety and health
55	ILSR # 721, 21.08.2007, PP RK	Rules for adoption by relevant authorities of regulations in the field of occupational health and safety
56	ILSR # 720, 21.08.2007, PP RK	Rules for provision of information and conduction of state statistics in the field of occupational safety and health

1	2	3
57	ILSR # 182-p, 31.07.2007, Ministry of Labor and Social Protection of the RK	On approval of the lists of productions, workshops, professions and positions, list of heavy work, work under harmful (particularly harmful) and (or) dangerous working conditions, which entitle the employee to reduced working hours and additional paid annual leave and Instructions for use of it.
58	Rules... The Order of the Ministry of Health and Social Development of the RK # 391, 27.05.2015	On approval of the list of works in which the workers under the age of eighteen are prohibited to work, the limits of weight of materials carried by employees who have not reached the age of eighteen, and a list of jobs forbidden to women, the limits of weight of materials carried by women.
59	List The Order of the Ministry of Health and Social Development of the RK # 379, 22.05.2015	On approval of the list of medical contraindications for conclusion of employment contracts in the field of heavy works, works with harmful (particularly harmful) and (or) dangerous working conditions, underground work, as well as for admission of decreed groups person to work
60	ILSR # 517, 20.06.2007, PP RK	Rules for development, assessment, adoption, amendment and cancellation of technical regulations
61	ILSR # 1277, 19.12.2003, PP RK	On approval of Rules for monitoring and accounting of individual radiation doses received by the citizens when working with sources of ionizing radiation during medical imaging procedures, as well as caused by radiation background
62	ILSR # 61, 20.02.2003, PP RK	On approval of the Agreement on application of technical, medical, pharmaceutical, sanitary, veterinary and phytosanitary rules, regulations and requirements in respect of goods imported into the CIS member states

1	2	3
63	ILSR # 112, 31.01.2003, PPRK	On approval of the Agreement on cooperation in the field of sanitary protection of the territories of the CIS states
64	SanPin # 127, 24.02.2015, MNE of the RK	On approval of the Sanitary Rules “Sanitary-epidemiological requirements to healthcare facilities”
65	SanPin # 155, 27.02.2015, MNE of the RK	On approval of health standards “Sanitary- epidemiological requirements to ensure radiation safety”
66	SanPin # 183, 03.03.2015, MNE of the RK	On approval of the Sanitary Rules “Sanitary-epidemiological requirements to the municipal facilities”
67	SanPin # 194, 12.03.2015, MNE of the RK	On approval of Sanitary Rules “Sanitary - epidemiological requirements to the organization and conduction of sanitary - epidemiological (preventive) measures to prevent infectious diseases”
68	SanPin # 64, 16.04.2013 PP RK	Sanitary - epidemiological requirements to organization and carrying out disinfection and deratization
69	SanPin # 178, 31.01.2012 PP RK	Sanitary - epidemiological requirements to sanatory and wellness facilities
70	SanPin # 291, 06.03.2012 PP RK	Sanitary - epidemiological requirements to collection, use, application, neutralization, transportation, storage and disposal of production and consumption waste
71	SanPin # 168, 25.01.2012 PP RK	Sanitary - epidemiological requirements to air quality in urban and rural areas, soils and their security, maintenance of areas of urban and rural settlements, conditions of work with sources of physical factors affecting human
72	SanPin # 167, 25.01.2012 PP RK	On approval of Sanitary Rules for industrial facilities
73	SanPin # 309, 11.03.2012 PP RK	Sanitary - epidemiological requirements to vehicles designed to transport passengers and goods

<b>1</b>	<b>2</b>	<b>3</b>
74.	SanPin # 308, 11.03.2012 PP RK	Sanitary - epidemiological requirements to radiation hazardous facilities
75.	SanPin # 201, № 202 or 03.02.2012 PP RK	Sanitary - epidemiological requirements to ensuring the radiation safety
76.	SanPin # 91, 17.01.2012 PP RK	Sanitary - epidemiological requirements to the facilities in the sphere of circulation of medicines, medical devices and medical equipment.
77.	SanPin # 32, 12.01.2012 PP RK	Sanitary - epidemiological requirements to organization and conduction of sanitary and anti-epidemic (preventive) measures to prevent infectious diseases (plague, cholera).
78.	SanPin # 89, 17.01.2012 PP RK	Sanitary - epidemiological requirements to organization and conduction of sanitary and anti-epidemic (preventive) measures to prevent parasitic diseases
79.	SanPin # 87, 17.01.2012 PP RK	Sanitary - epidemiological requirements to health care facilities
80.	SanPin # 104, 18.01.2012 PP RK	The sanitary - epidemiological requirements to water sources, water intake places for drinking purposes, drinking water supply and places of cultural and community water use and safety of water objects
81.	SanPin # 533, 23.07.2010 M3 PK	On amendments to the Order of acting Minister of Health dated 23.07.2010
82.	SanPin # № 885, 11.11.2010 MH RK	The sanitary - epidemiological requirements to operation of radio-electronic means and conditions of work with sources of electromagnetic radiation
83.	SanPin # 588, 03.08.2010 MH RK	The sanitary - epidemiological requirements to facilities for the processing and production of food products
84.	SanPin # 597, 04.08.2010 MH RK	The sanitary - epidemiological requirements to beer and soft drinks production facilities

<b>1</b>	<b>2</b>	<b>3</b>
85.	SanPin # 578, 30.07.2010 MH RK	Sanitary-epidemiological requirements to the facilities of wholesale and retail trade of food products
86.	SanPin # 656, 19.08.2010 MH RK	Sanitary-epidemiological requirements to catering facilities
87.	SanPin # № 587, 03.08.2010 MH RK	On approval of sanitary rules for facilities of railway transportation and conditions of transportation of goods
88.	SanPin # 795, 06.10.2010 MH RK	Sanitary-epidemiological requirements to establishment of sanitary protection zone of production facilities
89.	SanPin # 551, 28.07.2010 MH RK	On approval of sanitary rules for facilities of railway transport 1) sanitary-epidemiological requirements to passenger carriages 2) Sanitary-epidemiological requirements to services depot for passenger carriages
90.	SanPin # 550, 28.07.2010 MH RK	Sanitary-epidemiological requirements to the restaurant carriage of a passenger train and the conditions of carriage of organized children's groups by railway
91.	SanPin # 555, 28.07.2010 MH RK	Sanitary-epidemiological requirements to the public utilities facilities
92.	SanPin # 555, 28.07.2010 MH RK	Sanitary-epidemiological requirements to the public utilities facilities
93.	SanPin # 553, 23.07.2010 MH RK	Sanitary-epidemiological requirements to health care facilities
94.	SanPin # 350, 17.06.2008, MH RK	Organization and carrying out disinfection, disinfestation and deratisation measures on aircraft of civil aviation
95.	SanPin # 303, 23.05.2008, MH RK	Sanitary-epidemiological requirements to the design, maintenance and operation of radiology and therapy rooms
96.	SanPin # 302, 23.05.2008, MH RK	Sanitary-epidemiological requirements to design, maintenance and operation of food trade facilities
97.	SanPin # 293, 21.05.2008, MH RK	On amendments to the order of acting MOH of the RK dated 15.11.2004, # 811 "On Approval of SanPiN for epidemiology"

1	2	3
98.	SanPin # 277, 15.05.2008, MH RK	Sanitary-epidemiological requirements to the maintenance and operation of vegetable oils production facilities
99.	SanPin # 189, 08.04.2008, MH RK	On approval of SanPin 1) Sanitary-epidemiological requirements to design, maintenance and operation of disinfection-washing stations and complex points for preparation of covered train cars 2) sanitary-epidemiological requirements to working conditions and utility services for track serviceman 3) sanitary-epidemiological requirements to design, maintenance and operation of car repair shed
100.	SanPin # 677, 16.11.2007, MH RK	On approval of Rules for state registration, re-registration and withdrawal of the decision on the state registration of child nutrition products, food and food supplements (nutraceuticals), genetically modified sources, dyes, materials and products contacting with water and food, chemicals, certain types of products and substances that have harmful effects on human health
101.	SanPin # 671, 16.11.2007, MH RK	Organization and conduction of sanitary and anti-epidemic (preventive) measures to prevent Leishmaniasis
102.	SanPin # 669, 15.11.2007, MH RK	On approval of Rules for issue of legal, accounting and management of sanitary certificates for food production and storage facilities, for internal trade facilities
103.	SanPin # 507, 16.11.2007, MH RK and MA RK	On approval of SanPiN and veterinary and sanitary rules and regulations "Organization of epidemiological and epizootological surveillance and conduction of sanitary and anti-epidemic (preventive) and veterinary preventive (anti-epizootic) measures for listeriosis in RK"

1	2	3
104.	SanPin # 416, 06.07.2007, MH RK	On approval SanPin 1) sanitary-epidemiological requirements to the maintenance and operation of equipment for plasma treatment of materials 2) The sanitary-epidemiological requirements to the maintenance and operation of the foundry facilities
105.	SanPin # 394, 29.06.2007, MH RK	The sanitary-epidemiological requirements to design, construction, operation and maintenance of residential buildings
106.	SanPin # 308, 15.05.2007, MH RK	The sanitary-epidemiological requirements to ensuring radiation safety of drinking water
107.	SanPin # 307, 15.05.2007, MH RK	Sanitary-epidemiological requirements to the maintenance and operation of centers for control and organization of air traffic of civil aviation and working conditions of air traffic controllers
108.	SanPin # 306, 15.05.2007, MH RK	Sanitary-epidemiological requirements to the design, maintenance and operation of washing and steaming station and rail cars washing points
109.	SanPin # 305, 15.05.2007, MH RK	Sanitary-epidemiological requirements to maintenance and operation of track maintenance trains
110.	SanPin # 257, 27.04.2007, MH RK	Sanitary-epidemiological requirements to maintenance and operation of infant-feeding centers
111.	SanPin # 180, 20.03.2007, MH RK	Sanitary-epidemiological requirements to maintenance, operation of facilities for repair electric locomotives, diesel locomotives and working conditions of workers
112.	SanPin # 101, 13.02.2007, MH RK	On approval of SanPiN for railway transportation facilities and goods transportation conditions

1	2	3
113.	SanPin # 225, 10.04.2007, MH RK	Sanitary-epidemiological requirements to operation of radio-electronic means and conditions of work with sources of electromagnetic radiation
114.	SanPin # 626, 15.12.2006, MH RK	Sanitary-epidemiological requirements to maintenance and operation of motor vehicles
115.	SanPin # 468, 06.10.2006, MH RK	Sanitary-epidemiological requirements to equipment and maintenance of emergency trains
116.	SanPin # 349, 15.08.2006, MH RK	Sanitary-epidemiological requirements to working conditions and medical support during the infection control of nosocomial infections in medical institutions of the Republic of Kazakhstan
117.	SanPin # 336, 03.08.2006, MH RK	Sanitary-epidemiological requirements to agricultural irrigation fields
118.	SanPin # 295, 10.07.2006, MH RK	Sanitary-epidemiological requirements to maintenance and operation of washers, motor vehicles maintenance and repair stations (workshops).
119.	SanPin # 293, 10.07.2006, MH RK	Sanitary-epidemiological requirements to maintenance and operation of grain silos (elevators and grain receiving points)
120.	SanPin # 43, 03.02.2006, MH RK	On approval of sanitary-epidemiological rules and norms for railway transport facilities and goods transportation conditions
121.	SanPin # 42, 03.02.2006, MH RK	On approval of sanitary-epidemiological rules and norms for air terminals and aircraft of civil aviation
122.	SanPin # 349, 15.08.2006, MH RK	Sanitary-epidemiological requirements to working conditions and medical support during the infection control of nosocomial infections in medical institutions of Kazakhstan

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123.	SanPin # 220, 17.05.2006, MH RK	On approval of Rules for medical examination of workers directly related to the movement of trains on the railways transport of Kazakhstan
124.	SanPin # 130, 27.03.2006, MH RK	Sanitary-epidemiological requirements to maintenance of underground accommodations during disinfestation for destruction of household insects, synanthropic flies and mosquitoes
125.	SanPin # 335, 14.07.2005, MH RK	Sanitary-epidemiological requirements to the air of industrial premises
126.	SanPin # 335, 08.07.2005, MH RK	Sanitary-epidemiological requirements to ensure radiation safety of scrap metal
127.	SanPin # 334, 08.07.2005, MH RK	Sanitary-epidemiological requirements to design of production facilities
128.	SanPin # 311, 29.06.2005, MH RK	Sanitary-epidemiological requirements to maintenance and operation of petrol filling stations
129.	SanPin # 310, 29.06.2005, MH RK	Sanitary-epidemiological requirements to working conditions when welding, replating and cutting of metals
130.	SanPin # 232, 13.05.2005, MH RK	Sanitary-epidemiological requirements to the use of toxic substances (toxins)
131.	SanPin # 227, 13.05.2005, MH RK	Sanitary-epidemiological requirements to maintenance and operation of non-ferrous metals companies
132.	SanPin # 202, 28.04.2005, MH RK	Sanitary-epidemiological requirements to working conditions when working with agricultural machinery
133.	SanPin # 143, 24.03.2005, MH RK	Sanitary-epidemiological requirements to maintenance and operation of livestock facilities and fur facilities
134.	SanPin # 137, 24.03.2005, MH RK	On approval of sanitary-epidemiological rules and norms for environmental sanitation

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135.	SanPin # 136, 24.03.2005, MH RK	Sanitary-epidemiological requirements to maintenance of and working conditions in laboratories performing chemical, toxicological, radiological analysis
136.	SanPin # 137, 24.03.2005, MH RK	Sanitary-epidemiological requirements to maintenance and operation of laundry service facilities
137.	SanPin # 105, 09.03.2005, MH RK; № 214, 18.03.2005 MA RK	Sanitary-epidemiological requirements and veterinary-sanitary requirements to maintenance and operation of semifinished milk facilities
138.	SanPin # 104, 09.03.2005, MH RK	Sanitary-epidemiological requirements to maintenance and operation of greenhouses
139.	SanPin # 101, 09.03.2005, MH RK	Sanitary-epidemiological requirements to radiation safety of oil and gas facilities
140.	SanPin # 63, 18.02.2005, MH RK	Sanitary-epidemiological requirements to maintenance of sanitary protection zones of water supply sources and drinking and household water supply systems
141.	SanPin # 60, 17.02.2005, MH RK	Sanitary-epidemiological requirements to maintenance and operation of facilities for production of meat and meat products, their storage and transport
142.	SanPin # 401, 15.08.2005, MH RK	On approval of SanPiN for maintenance and operation of railway transport facilities: 1) Sanitary-epidemiological requirements to preparation for travel and maintenance in transit of electric and diesel trains; 2) Sanitary -epidemiological requirements to maintenance and operation of houses, recreation rooms of locomotive crews; 3) Sanitary-epidemiological requirements to maintenance and operation of railway stations

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143.	SanPin # 358, 14.07.2005, MH RK	On approval of SanPiN for rail transport: 1) sanitary-epidemiological requirements to maintenance and operation of passenger cars; 2) Sanitary-epidemiological requirements to maintenance and operation of maintenance points, servicing of passenger cars
144.	SanPin # 355, 14.07.2005, MH RK	Sanitary-epidemiological requirements to the air of industrial premises
145.	SanPin # 329, 07.07.2005, MH RK	Sanitary-epidemiological requirements to floating drilling rigs
146.	SanPin # 325, 05.07.2005, MH RK	Sanitary-epidemiological requirements to conditions of work with I-IV microorganisms
147.	SanPin # 201, 28.04.2005, MH RK	Sanitary-epidemiological requirements to maintenance of facilities for production of milk and dairy products, their storage and transport
148.	SanPin # 137, 24.03.2005, MH RK	On approval of SanPiN for environmental sanitation: 1) sanitary-epidemiological requirements to maintenance and operation of laundry service facilities; 2) Sanitary-epidemiological requirements to maintenance of populated areas; 3) Sanitary-epidemiological requirements to maintenance and operation of facilities for production of perfume and cosmetic products and oral hygiene products
149.	SanPin # 36, 02.02.2005, MH RK; №108, 07.02.2005, MA RK	On strengthening measures to control ringworm, common to humans and animals



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150.	SanPin # 905, 30.12.2004, MH RK; 10.01.2005, MA RK	Organization of epidemiology-epizootological surveillance and sanitary and anti-epidemic (preventive) and veterinary measures to prevent anthrax in Kazakhstan
151.	SanPin # № 811, 15.11.2004, MH RK	On approval of sanitary-epidemiological rules and norms for Epidemiology
152.	SanPin # 700, 20.09.2004, MH RK	On approval of Instruction for sanitary and anti-epidemic (preventive) measures to prevent parasitic diseases in the Republic of Kazakhstan
153.	SanPin # 631, 18.08.2004, MH RK	On approval of sanitary-epidemiological rules and norms for municipal hygiene and hygiene of children and adolescents
154.	SanPin # 630, 18.08.2004, MH RK	On approval of sanitary-epidemiological rules and norms for epidemiology and food hygiene
155.	SanPin # 629, 18.08.2004, MH RK	On approval of sanitary-epidemiological rules and norms for hygiene and epidemiology
156.	SanPin # 631, 18.08.2004, MH RK	Sanitary-epidemiological requirements to operation of personal computers, video terminals and the conditions of working on them
157.	SanPin # 630, 18.08.2004, M3 PK	Sanitary-epidemiological requirements to maintenance and operation of physiotherapy and acupuncture departments (offices).
158.	SanPin # 629, 18.08.2004, MH RK	Sanitary-epidemiological requirements to the maintenance and operation of infectious hospitals (departments)
159.	SanPin # 629, 18.08.2004, MH RK	Sanitary-epidemiological requirements to air
160.	SanPin # 632, 18.08.2004, MH RK	Sanitary-epidemiological requirements to women working conditions

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161.	SanPin # 507, 28.06.2004, MH RK	Sanitary-epidemiological requirements to aviation-technical bases of civil aviation
162.	SanPin # 506, 28.06.2004, MH RK	Sanitary-epidemiological requirements to protection of surface waters against pollution
163.	SanPin # 297, 30.03.2004, MH RK	Sanitary protection of the borders and the territory of the Republic of Kazakhstan
164.	SanPin # 19, 13.01.2004, MH RK	Sanitary-epidemiological requirements to collection, use, neutralization, transportation, storage and disposal of wastes of medical organizations
165.	SanPin # 632, 18.08.2004, MH RK	On approval of SanPiN: 1) Sanitary-epidemiological requirements to maintenance, operation and quality of water in swimming pools; 2) Sanitary-epidemiological requirements to labor conditions for women; 3) Sanitary-epidemiological requirements to maintenance and operation of hairdressing and beauty shops, beauty salons and centers
166.	SanPin # 100, 30.01.2004, MH RK	Sanitary-epidemiological requirements to design, maintenance and operation of food trade facilities
167.	SanPin # 63, 21.01.2004, MH RK	Sanitary-epidemiological requirements to arrangement and operation conditions of microbiology, virology and parasitology laboratories
168.	SanPin # 641, 28.08.3003, MH RK	Sanitary-epidemiological requirements to arrangement and maintenance of designated smoking areas
169.	SanPin # 570, 25.07.2003, MH RK	Sanitary-epidemiological requirements to design, maintenance and training conditions in genera educationl and residential care institutions

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170.	SanPin # 266, 15.05.2003 MA RK; № 376, 14.05.2003, MH RK	On approval of sanitary and epidemiological and veterinary-sanitary rules for prevention and control of communicable diseases common to animals and humans (rabies)
171.	SanPin # 94, 31.01.2003, MH RK	Sanitary and anti-epidemic requirements to bread, bakery, pasta and confectionery products production organizations
172.	SanPin # 14, 24.12.2002, MH RK	On measures to prevent malaria and other tropical parasitic diseases
173.	SanPin # 701, 17.09.2002, MT and C RK	On approval of Instruction on transport of dangerous goods by civil aircraft
174.	SanPin # 3-01.002-96, MH RK	Sanitary rules and norms for protection of the population from the effects of electromagnetic fields generated by radio- technical facilities
175.	ILSR № 59, 31.01.2011 MH RK; № 45, 25.02.2011 МЭПnТ PK	On approval of criteria for assessing the degree of risk in the field of private enterprise in the field of sanitary and epidemiological wellbeing of the population
176.	ILSR # 73, 05.02.2010 MH RK; № 40, 09.02.2010 МEBP RK	On approval of the form of checklists in the field of sanitary and epidemiological wellbeing of the population
177.	ISLSR # 902, 20.12.2011 MH RK	On approval of the list and forms of records of sanitary-epidemiological service bodies and organizations
178.	ISLSR # 731, 18.11.2009, MH RK	Rules for issue, recording and keeping the sanitary passport
179.	ISLSR # 709, 16.11.2009, MH RK	Rules for conduction of mandatory medical examinations
180.	ISLSR # 48, 11.02.2005, MH RK	On approval of the list of professions requiring pre-shift medical examination
181.	ISLSR # 139, 24.03.2005, MH RK	On approval of hygienic standards for noise levels in the workplace

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182.	ISLSR # 841, 03.12.2004, MH RK	On the approval of hygienic standards: 1) MPC SRLI of hazardous substances in the air of working area; 2) Hygienic standards of noise and infrasound levels in residential and public buildings and in residential areas
183.	ISLSR # 980, 30.12.2003, MH RK	On creation of and keeping the register of potentially dangerous chemical and biological substances that are prohibited for use in the Republic of Kazakhstan
184.	ISLSR # 13, 30.03.2007, HSHP RK	On limiting public exposure during Radiology Medical Investigation
185.	ISLSR # 97, 08.12.2006, KTCЭH PK	On approval of hygienic norms
186.	ISLSR # 12, 06.12.2003, HSHP RK	On measures to reduce the negative impact of physical factors on human health
187.	ISLSR # 12, 27.08.2002, HSHP RK	On sale of the yeast with excess of maximum allowable concentration of highly toxic substances
188.	SN # 5189-80, 29.12.1984, MH RK	The order of accumulation, transportation, disposal and dumping of toxic industrial waste
189.	PS # 182-p, 31.07.2007, ML and SP RK	Instructions for use of the List of productions, workshops, professions and positions, list of heavy works, works under harmful (particularly harmful) and (or) dangerous working conditions which entitle the employee to reduced working hours and additional paid annual leave
190.	PS # 700, 20.09.2004, MH RK	On approval of Instructions for the sanitary and anti-epidemic (preventive) measures to prevent parasitic diseases in Kazakhstan
191.	SI # 203-n, 23.08.2007, ML and SP RK	Rules for mandatory periodic labor conditions certification of industrial facilities
192.	SI # 205-n, 23.08.2007, ML and SP RK	Rules for training, briefing and testing of knowledge of workers on health and safety

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193.	SI # 157-п, 16.07.2007, ML and SP RK	Rules for development and approval of occupational safety and health instructions by the employer
194.	SI # 312-п, 27.12.2004, ML and SP RK	On approval of rules on safety knowledge assessment for managers and persons responsible for health and safety in organizations
195.	SI # 349, 20.04.2004, MH RK	On approval of issuance, accounting of and keeping the sanitary passport for vehicle
196.	SI # 135, 09.02.2004, MH RK	On approval of Rules for conduction of sanitary-epidemiological monitoring
197.	SI # 99, 31.01.2004, MH RK; № 21-п, 27.01.2004, MO	On approval of standards for maximum permissible concentrations of harmful substances, harmful microorganisms and other biological pollutants in soil
198.	SI # 688, 17.09.2003, MH RK	On approval of rules for organizing and conducting hygiene training for decreed population groups
199.	SI # 766, 20.10.2003, MH RK	On approval of rules for compulsory medical examinations of decreed groups
200.	SI # 12, 06.11.2003, MH RK	On measures to reduce the negative impact of physical factors on human health
201.	SI # 556, 23.10.2009, MH RK	Rules for issue of medical disability certificate to citizens
202.	RP # 10.7.065/p-94, MH RK	Recommended practice for implementation of the state sanitary inspection at the enterprises producing and applying asbestos
203.	RP # 1.10.084/p-94, MH RK	Recommended practice for control of organization of current and final demercurisation and evaluation of its effectiveness
204.	RP # 1.03.034/y-94, MH RK	Recommended practice for sanitary control over design, production, release of portable equipment and working conditions of workers of vibrodabgerous professions
205.	RP # 1.02.019/p-94, MH RK	Recommended practice for laboratory control over the sources of electromagnetic fields of non-ionizing part of spectrum (EMF) in conduction of state sanitary surveillance

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206.	RP # 1.02.018/y-94, MH RK	Recommended practice for conduction of state sanitary surveillance of facilities with sources of electromagnetic fields (EMF) of non-ionizing part of the spectrum
207.	RP # 1.02.013/y-94, MH RK	Recommended practice for measurement and hygienic evaluation of production vibrations
208.	RP # 1.02.008/y-94, MH RK	Recommended practice for hygienic evaluation of productive and unproductive noise load
209.	RP # 1.01.004/p-94, MH RK	Conduction of preventive and current sanitary supervision over artificial lighting at industrial enterprises (recommended practice)
210.	RP # 1.01.003/y-94, MH RK	Sanitary-hygienic control of ventilation systems at industrial premises (guidelines)

These statutory instruments are developed and approved by the state bodies in accordance with the Resolution of Government of the RK dated August 21, 2007 # 721.

On the basis of the above-mentioned instruments, each entity of the Republic of Kazakhstan, taking into account the specific working conditions, develops corporate instruction for occupational safety, occupational and personal sanitation, according to the Rules established by the Resolution of the Government of the RK dated August 21, 2007 3 721, by order of the Minister of Labour and Social Protection of Population dated December 2, 2004, # 278-p.

The system of technical regulation applied in Kazakhstan is aimed not only at ensuring the most cost-effective production, but above the all, at protecting the life and health, environment. The system of technical regulation in the Republic of Kazakhstan is based on the technical basis of the former USSR (Union of Soviet Socialist Republics) which consisted of GOSTs, SNIps, SanPiN, regulations, instructions, provisions, guidelines, circulars, regulatory letters and etc.

Table No.2. The types of number of regulatory acts in the field of occupational safety and health.

Name of the type of statutory instrument		Bodies approved the statutory instruments
Full	Abbreviated	
State standards of the system of health and safety standards	GOST HSSS	Government of the RK Ministries and departments of the RK
Industry standards of the system of health and safety standards	IS HSSS	Ministries and departments of the RK
Sanitary rules	SR	Ministry of Health of the RK
Sanitary norms	SN	
Hygienic standards	HS	
Sanitary rules and norms	SanPin	
Building codes and regulations	SNiP	Ministries and departments of the RK
Safety rules	SR	Government of the RK Ministry of Labor and Social Protection of the RK
Rules for arrangement and safe operation	RASO	
Safety Instructions	SI	
Inter-industry labor safety rules	IILSR	
Inter-industry organizational and methodical documents (technical regulations, provisions, recommended practices, recommendations)	TR RP MR	Government of the RK Ministries and departments of the RK
Industry labor safety rules	ILRS	Government of the RK Ministries and departments of the RK
Model industry health and safety instructions	PS	
Industry organizational and methodical documents (technical regulations, provisions, recommended practices, recommendations)	TR RP MR	

In the case of change in Kazakh occupational safety legislation, inter-industry rules, technical regulations on occupational safety, due to introduction of new techniques and technologies, and based on the results of analysis of industrial accidents, general and occupational disease rate, state regulatory requirements in the field of health and safety can be reviewed regardless of their established validity.

Collective and individual employment contracts, all kinds of agreements and instructions on occupational safety, enterprise standards, regulations, orders, etc refer to the local occupational safety regulations.

**The agreement** is a the legal act regulating social and labor relations between employees and employers which may involve regulations on remuneration, working conditions and occupational health and safety, schedule of works and rest; all kinds of additional compensatory payments and special measures for social protection of workers.

**The collective agreement** is the founding document for organization of labor relations, the legal form of accommodation of employer's and employee's interests.

The collective agreement shall include employer's and employees' mutual obligations for the following:

- Standartization, forms, remuneration systems, the size of tariff rates and salaries, allowances and bonuses to employees, including those engaged in heavy work or work under harmful (particularly harmful) and (or) dangerous working conditions;
- Salary indexation. Payment of benefits and compensation payments, including additional compensation in case of accidents;
- Acceptable ratio between the maximum and minimum salary in the respective profession, position in the organization;
- Number of working hours and duration of resting time, annual leave;
- Creation of a healthy and safe working and living conditions, amount of funding for health and safety measures, improvement of occupational health and safety, guarantee of health insurance to employees and their families, protection of the environment;
- Regulation of labor regulations and labor discipline;
- Health care, health resort treatment and rest of workers;
- Insurance of employees;

- Employee's and the employer's responsibility for any damage caused by them.

The content of the collective agreement may include any terms which are not contrary to the law and do not impair the position of the employee compared to the rules established by other normative legal acts and agreements related to labor relations.

**The employment contract** is a written agreement between the employee and the employer, whereby the employee undertakes to perform using own efforts a specific job (labor function), to comply with labor regulations, and the employer shall give the employee work according to a given employment function, provide the working conditions specified by the Labor Code of the RK, laws and other normative legal acts of the Republic of Kazakhstan, collective agreements, employer's acts, and pay the employee full salary in due time.

The employment contract usually includes a mandatory condition as a minimum scope of rights and obligations, and additional conditions which are determined by agreement between the parties and improve the terms of the contract compared to mandatory conditions.

The corporate labor policy is developed by the employer on the basis of regulations, collective agreements, taking into account the specifics of the enterprise's activity, as well as in accordance with the Regulation "On the staff". Labour discipline is provided by the employer through creation of the necessary organizational and economic conditions for individual and collective labor, worker morale, methods of persuasion, incentives for hard work, as well as disciplinary methods for committing by the worker of misconduct.

**Working time** is the time during which the employee in accordance with the employer's acts and the terms of the employment contract carries out employment duties, as well as other periods of time, which, in accordance with the Labor Code of the Republic of Kazakhstan classified as working time.

According to the Labor Code of the Republic of Kazakhstan, article 77 LC of RK the latter repeats the provisions of ILO Conventions # 47 dated June 22, 1935, "On reducing the working hours to forty hours a week." This means that regardless of type of

activity and the nature of the work, the organizational and legal form and ownership of the employer, the maximum number of working hours for all workers shall not exceed forty hours per week. This provision should be executed and applied by the parties of the employment contract, irrespective of the type of working week and the established working time, including its summarized recording (**summarized recording of working time** – recording of working time through summing up of working time for the record period established by the employer which shall not exceed one year).

The following weekly hours of work is established for employees under the age of eighteen years:

- for employees at the age of fourteen to sixteen years - no more than 24 hours a week;
- for employees at the age of sixteen to eighteen years - no more than 36 hours a week;
- for students of educational institutions combining the study with work, at the age of fourteen to sixteen years - 2.5 hours a day, at the age of sixteen to eighteen years - 3.5 hours a day.

The short working hours for employees engaged in heavy work or work under harmful (particularly harmful) and (or) dangerous working conditions, amount to no more than 36 hours a week.

At the same time, the basis for application of this article is the order of acting Minister of Labour and Social Protection of the Republic of Kazakhstan dated July 31, 2007 # 182-p "On Approving the List of production facilities, workshops, professions and positions, list of heavy work, work under harmful (particularly harmful) and (or) dangerous working conditions, which entitle the employee to reduced working hours and additional paid annual leave, and instructions for its use" as amended ( the order of Minister of Health and Social Protection dated August 28, 2008 # 226-p).

The short working time of no more than 36 hours a week with limitation of no more than seven hours a day is set for disabled employees of the first and second group.

Summarized recording of the working time is not allowed in relation to the disabled employees of the first and second group. The summarized recording of working time shall not be established for disabled employees of the third group, if such working pattern is prohibited for them due to medical reasons.

In addition to above cases, established by the LC of the RK and other normative legal acts, the shorter working hours than the established working hours can be determined by regulatory acts, the shorter working hours than established working hours can be determined by a collective agreement or employer's corporate act at its own costs.

*Types of work week:*

1. A five-day working week with two days off is established for employees. Duration of daily work (shift) for five-day working week is determined by the employer's act taking into account the specifics of the work and in compliance with the established duration of the working week.
2. The six-day working week with one day off is established in organizations where introduction of five day work is impractical due to the operating mode and working conditions.
3. The five-day or six-day working week is established by the employer in accordance with the terms and conditions of employment and (or) collective agreements.

*Duration of daily work (shift):*

1. In the case of five-day working week, duration of daily work (shift) shall not exceed 8 hours at weekly limit of 40 hours, and 7 hours and 12 minutes at weekly limit of 36 hours, 5 hours at a weekly limit of 24 hours.
2. In the case of six-day working week, duration of daily work (shift) shall not exceed 7 hours at a weekly limit of 40 hours, 6 hours at a weekly limit of 36 hours and 4 hours at a weekly limit of 24 hours.
3. The duration of daily work (shift), the start and end of daily work (shift), duration of breaks are determined according to duration of the working week labor established by labor regulations of the company, employment and collective agreements.
4. For the creative professionals of arts and cultural entertainment organizations, media professionals, athletes, coaches, a different duration of daily work (shift) can be established in accordance with the labor laws of the Republic of Kazakhstan, employer's acts, collective or employment contract.

The main type of workweek applied in organizations is a five-day working week with two days off as the best form of working time.

Due to the fact that long working hours have a negative impact on the performance of employees, the legislation establishes not only weekly working hours, but also maximum allowable limits of duration of workweek which can not be increased.

The following is required in determining the duration of daily work (shift):

- Compliance with established laws of the working week;
- Provision of the rest and lunch breaks for a period of at least one hour in general during the working day (shift);
- Ensuring that duration of the daily rest period between the end of the work and its start on the next day (shift) is not less than 12 hours.

Assignment of night timework for disabled employees is allowed only upon their written consent, if such work is not prohibited for them due to medical reasons.

It is prohibited to assign the persons under age of 18 with night works even with their consent.

The employer is not entitled to assign the pregnant women with night work, even with their written consent.

The Labour Code establishes a certain limits for assignment of overtime work which is prohibited for pregnant women, employees under age of eighteen (***overtime work*** is a work performed by the employee at the initiative of the employer outside the fixed hours of work). Work is recognized to be overtime work regardless of whether it is included in the range of employee responsibilities according to his/her, specialty, position or the employee performs other work entrusted to him/her by the employer. Overtime work shall not exceed 4 hours during a day for each employee, and heavy work or work under harmful (particularly harmful) and (or) dangerous working conditions shall not exceed 1 hour. The total duration of overtime work shall not exceed 12 hours per month and 120 hours per annum (Article 89 of LC of the RK).

***Time off work*** is a period of time in which an employee is allowed to take time off from his/her job and use it at his own discretion.

Rest breaks are provided with a view to refresh physical and spiritual strength, which is provided by rest and lunch breaks during the working day (work shift), daily (between shifts) rest, days off (uninterrupted weekly rest period), public holidays and vacations. In

addition, taking into account the nature of work, the employer shall provide workers with special breaks during the working time subject to technology and organization of labour. Unlike with rest and lunch breaks, they are provided during the working time and included in the working time and paid. It is also envisaged to provide special breaks for warming and rest of employees working outdoors in cold seasons or in closed unheated premises. Issues concerning the number and duration of breaks for warming and arrangement of warming place are addressed by the employer, and such breaks are included in working time and paid.

In addition to rest and lunch breaks, intrashift and special breaks, women with children under the age of one and a half years, fathers (adoptive parent, adopter) with children under the age of one and a half years without mother are provided with breaks for feeding the child (children) at least every three hours with following duration:

- in the case of one child - each break of at least thirty minutes;
- in the case of two or more children - each break of at least one hour.

Work in weekends and holidays at the initiative of the employer is allowed only with written consent of the employee and shall be paid not less than twice the amount of the employee's daily rate.

A prerequisite for control and the normal operation of any organization is labour rating. The procedure for development and approval of basic (inter-industry, trade, industry and other) labor standards is established by the order of the Ministry of Labour and Social protection of the RK dated July 19, 2007, # 166-p “*On Adoption of Rules for approval, replacement and revision of model rules and regulations on labor by respective state authorities*”.

**Typical labor standards (output, time, service)** is specified values of cost of labour for execution of separate elements or package of works according to standard technology, service of equipment unit, place of work, as well as number of employees required to carry out the production, management functions, depending on practical organizational and technical conditions.

**Labor standards** is specified values (quantity) of costs of labour for execution of separate elements (complexes) of works according, service of equipment unit, place of work, business unit, as well as number of employees required to carry out the production, management functions or scope of works taken as a unit of measure,

depending on certain organizational and technical conditions and production factors.

**Labour rating** is one of the most important factors in labor organization which is aimed at establishing the required cost and results of labor, as well as favorable ratio between the number of employees of different categories and groups.

In determining the performance standard for employees, the following worktime standards are applied:

- ✓ Time standard;
- ✓ Performance output;
- ✓ Service standard;
- ✓ Quantity standard;
- ✓ Standard tasks;
- ✓ Uniform and standard norms.

**Time standard** is the amount of work time expenditure, established for execution of unit of work by employee or group of employees (team) having relevant qualifications in certain organizational and technical conditions.

**Performance output** is a specified amount of work (number of production units) to be executed (manufactured, transported etc) by an employee or group of employees (in particular, team) having relevant qualifications within the unit of working time in certain organizational and technical conditions.

**Quantity standard** is a specified number of employees of a particular professional qualification structure required to execute a specific production, management functions or the scope of work in certain organizational and technical conditions.

**Service standard** is the number of production facilities (equipment units, work places, etc.) which is to be serviced by employee or group of employees (in particular, for example, the team) having relevant qualifications within unit of working time in certain organizational and technical conditions.

Employment contracts, collective agreements and (or) employer's acts shall regulate the issues of labour rating. At the same time, the included labour rating provisions may not restrict employee's rights, deteriorate the working conditions and violate the guarantees established by law.

In order for employee to meet the performance output, the employer shall provide such working conditions that preclude the adverse influence of production environment factors and labor process on the health of employees.

Performance outputs for employees under the age of eighteen shall be established on the basis of performance outputs for adult employees in proportion to the short working hours for persons under the age of eighteen years according to the employment contract.

With regard to labour rating, parties' obligations for appropriate assignment of workers' professions and employees' positions and their attribution to appropriate categories and skill categories of workers' professions and employees' positions serving based on works and workers' qualification reference book, employees' positions qualification reference book shall be described taking into account the complexity of works performed and employee's qualifications.

The introduction of new worktime standards shall provide prior notification of employees about the introduction of new standards, creation of working conditions at place of work in accordance with the hygiene requirements specified in the new standards, no later than one month before the official application of the new standards. Induction and routine briefings are conducted for employees, where necessary.

Every employee, who will be affected by new standards, shall be notified by the employer in writing no later than one month before official application of new standards. If the employee does not agree to continue the work with the new worktime standards, he/she shall be offered another job in the organization, corresponding to his/her qualifications and state of health, and in the case of absence thereof - other lower-paid job.

The implementation of these areas of public policy in the field of occupational safety and health related to determination of responsibilities and tasks of the authorized health and safety body, employee and employer is provided jointly agreed actions of the government, ministries offices and departments, local authorities, employers and labor unions. The Labor Code of the RK determines the uniform nation-wide procedure for regulation of health and safety relations between employers and employees, regardless of form of

ownership, the scope of business and departmental affiliation of enterprises, organizations and institutions.

**Article 16** of the Labor Code of the Republic of Kazakhstan determines competence of the authorized state labor authority in the field of regulation of labor relations:

The state labour authority:

- regulates state policy in the sphere of labour, health and safety
- adopts regulatory and legal acts of the Republic of Kazakhstan establishing general requirements on occupational health and safety for all spheres of activity; 13
- organises state control over observance of the labour legislation of the Republic of Kazakhstan on employment of the population and the requirements on occupational health and safety;
- co-ordinates activities of state authorities in developing technical regulations in the sphere of occupational health and safety;
- conducts co-ordination and interaction in the sphere of occupational health and safety with other state authorities, as well as with representatives of employees and employers;
- establishes the format, the procedure maintaining and keeping service records;
- establishes the procedure for replacing and reviewing labor standard norms and regulations;
- establishes the procedure for presenting, reviewing and agreeing the worktime standards in organizations the services (goods, work) of which are embraced by state regulation of tariffs (prices, rate of charges);
- establishes the procedure for presenting, reviewing and agreeing parameters with respect to the system of labour compensation of employees of organisations the services (goods, work) of which are embraced by state regulation of tariffs (prices, levies);
- registers industry agreements and regional agreements concluded at the level of the region (city of republican significance, capital);
- carries out training and certification of state labour inspectors;



- exercises control over timely and objective investigation of industrial accidents in the manner established by the legislation of the Republic of Kazakhstan;
- carries out international co-operation in the sphere of regulation of labour relations;
- elaborates programmes for investigating the occupational health and safety problems;
- elaborates and approves the procedure and standards for providing employees with milk, healthy meals, special clothing, special footwear and other means of personal protection, and establishes the procedure for supplying them with means of collective protection, sanitary and living premises and equipment at the employer's expense;
- determines the procedure for elaborating, reviewing, approving and applying handbooks and qualification characteristics;
- considers and agrees model qualification characteristics for the positions of heads, experts and other officials of organisations engaged in various types of economic activities;
- establishes the procedure for approval of model worktime standards and regulations by relevant competent state authorities;
- on agreement with an authorised state body in the sphere of healthcare, determines the list of jobs for which it is prohibited to employ employees under the age of eighteen and maximum weights for transfer and movement by employees under the age of eighteen;
- on agreement with an authorised state body in the sphere of healthcare, determines the list of jobs for which it is prohibited to employ female employees and maximum weights for manual transfer and movement by female employees;
- determines the list of production facilities, workshops, professions and jobs, the list of heavy work and work under harmful (particularly harmful) and (or) hazardous working conditions;
- organises monitoring and assessment of risks in the sphere of occupational health and safety;

- establishes the procedure for mandatory periodical certification of production facilities with respect to working conditions;
- approves the Model provision on occupational health and safety service in organization.

**Article 22** of the Labor Code of the Republic of Kazakhstan determines the basic rights and duties of the employee:

The employee shall have the right to:

- conclude, amend, supplement and cancel an employment contract in the manner and on the conditions envisaged by this Code;
- demand from employer fulfillment of conditions of the employment contract and collective agreement;
- occupational health and safety;
- receive full and true information about the working conditions and labour safety;
- timely and full payment of wages in accordance with the conditions of the employment contract and collective agreement;
- payment for idle time in accordance with this Code;
- rest, including annual paid vacation;
- association, including the right to create a labor union or other association, and be a member thereof for the purpose of representation and protection of his/her labour rights, unless otherwise envisaged by the laws of the Republic of Kazakhstan;
- participate through his/her representatives in collective negotiations and in elaboration of the draft collective agreement, and to familiarise himself/herself with the signed collective agreement;
- professional training, further training and professional development in the manner envisaged by this Code;
- recompense for harm caused to his/her health in connection with fulfillment of job duties;
- mandatory social insurance in cases envisaged by the laws of the Republic of Kazakhstan;
- guarantees and compensation payments;
- protection of his/her rights and lawful interests by all manners not in contravention of the law;

- equal payment for equal labour without any discrimination;
- referral of a labour dispute to a mediation commission or court of law, at his/her own choice;
- a work place equipped in accordance with the requirements of occupational health and safety;
- provision with personal and collective means of protection and special clothing in accordance with the requirements envisaged by the legislation of the Republic of Kazakhstan on occupational health and safety, as well as the employment contract and collective agreement;
- refuse to perform work in a situation jeopardising his health or life, with notification of his immediate manager or the employer's representative to this effect;
- retention of his average wage during suspension of the work of organisation as a result of failure to comply with occupational health and safety requirements;
- apply to the state labour authority or its territorial subdivisions for investigation of the occupational health and safety conditions at the work place, as well as at representative participation in the investigation and consideration of issue connected with improving working conditions, occupational health and safety;
- appeal against actions (omissions) by the employer in the sphere of occupational health and safety;
- payment for labour in accordance with his/her qualification, the complexity of the work, the quantity and quality of work performed, as well as working conditions;
- participation in management of the organization in forms envisaged by this Code, other laws of the Republic of Kazakhstan and the collective agreement;
- resolution of individual and collective labour disputes, including the right to strike, in the manner established by this Code and other laws of the Republic of Kazakhstan.

The employee shall:

- perform his job duties in accordance with the employment contract, collective agreement, and acts of the employer;
- observe labour discipline;
- observe the occupational health and safety requirements, fire safety and production hygiene requirements at the work place;

- take care of the property of the employer and of employees;
- inform the employer of any situation jeopardising human life and health, safekeeping of property of the employer and of employees, as well as threatening occurrence of idle time;
- not disclose information constituting state secrets, official, trade or other secrets protected by law that becomes known to him in connection with performance of his job duties;
- reimburse the employer for harm caused, within the limits established by this Code.

*Article 23 of the Labor Code of the Republic of Kazakhstan determines the basic rights and obligations of the employer:*

The employer shall have the right to:

- 1) free choice of hiring;
- 2) amend, supplement or cancel employment contracts with employees in the manner and on the grounds established by this Code;
- 3) issue acts of the employer within the bounds of its authority. Issue of acts connected with a change of working conditions shall be carried out in accordance with article 48 of this Code;
- 4) create and join associations for the purpose of representation and protection of its rights and interests;
- 5) require employees to fulfill the conditions of employment contracts, collective agreements, internal labour rules and other acts of the employer;
- 6) give incentives to employees, impose disciplinary sanctions and hold employees materially liable in cases and in the manner envisaged by this Code;
- 7) recompense for harm inflicted by an employee in performance of his/her job duties;
- 8) appeal to a court of law for the purpose of protecting its rights and lawful interests in the sphere of labour;
- 9) set a probation period for the employee;
- 10) recompense for expenditures connected with training the employee, if this is stipulated by the conditions of the employment contract.

The employer shall:

- observe the requirements of the labour legislation of the Republic of Kazakhstan, agreements, collective agreements, employment contracts, and acts issued thereby;
- when hiring, conclude employment contracts with employees in the manner and on the conditions established by this Code;
- exercise internal control over occupational health and safety;
- provide the employee with the work prescribed by the employment contract;
- pay the employee wages and other payments envisaged by the regulatory and legal acts of the Republic of Kazakhstan, the employment contract, collective agreement, and acts of the employer in a timely manner and in full;
- familiarize the employee with acts of the employer and the collective agreement;
- provide the employees' representatives with full and accurate information, as required for conducting collective negotiations, concluding collective agreements, and monitoring their execution;
- consider proposals submitted by employees' representatives, hold collective negotiations and, in the manner established by this Code, conclude a collective agreement;
- provide employees with working conditions in accordance with the labour legislation of the Republic of Kazakhstan, employment contracts and collective agreements;
- provide employees with equipment, tools, technical documentation and other means necessary for performance of their job duties at its own expense;
- fulfill instructions issued by state labour inspectors;
- suspend work if its continuation creates a threat to the life or health of the employee and other persons;
- undertake mandatory social insurance of employees;
- insure civil law liability for causing harm to the life and health of the employee in fulfillment thereby his job duties;
- provide the employee with annual paid vacation;

- ensure the safekeeping and submission to the state archives of documents confirming the labour activities of employees, and information on withholding and payment of funds for their pension provision;
- warn the employee of harmful (particularly harmful) and (or) hazardous working conditions and the possibility of occupational disease;
- take measures to prevent risks at the work place and in manufacturing processes, and perform preventive work in consideration of production and scientific and technical progress;
- precisely record time worked by each employee, including overtime, under harmful (particularly harmful), hazardous working conditions, and doing heavy work;
- provide employees with occupational training, retraining and professional development in accordance with this Code;
- provide recompense for harm caused to the life and health of the employee, in accordance with the legislation of the Republic of Kazakhstan;
- provide officials of the state labour authority and of territorial subdivisions of the state labour authority, employees' representatives and public labour safety inspectors with unimpeded access for checking on labour protection, working conditions and labour safety in organizations and observance of the legislation of the Republic of Kazakhstan on labour protection and labour safety, as well as for investigating industrial accidents and occupational diseases;
- demand, at the time of hiring, the documents necessary for concluding an employment contract in accordance with article 31 of this Code.

### Chapter 3 HEALTH AND SAFETY

The main and core objective of the state policy in the field of occupational health is to ensure the priority of life and preservation of the health of employees. Yearly the state increases the rate of provisional measures in this field - whether it is about the adoption of new regulations on the creation of a comfortable working environment, all types of technical regulations, sector and cross-industry standards and the ratification of ILO Conventions. Existing regulations in the field of health and safety set organizational, technical, technological, sanitary, biological, physical and other rules, regulations, procedures and criteria aimed at preservation of the life and health of employees in their labor activity [19-23].

State administration, control and supervision in occupational safety and health is carried out by the Government of the Republic of Kazakhstan and other authorized government labor agencies within their competence (MLSP, Ministry of Health of RK, Sanitary Inspection Committee of RK, State Mining and Safety Organization et al.).

Labor Code of the Republic of Kazakhstan identifies the guarantee of employees' rights to safety and health in the labor activity.

In this case the employee has a right to:

- workplace equipped in accordance with the safety requirements and occupational safety;
- provision of ablution facilities, means of individual and collective protection, special wear in accordance with the safety and health requirements, as well as employment and collective agreements;
- appeal to the authorized labor body and territorial units thereof to survey conditions and safety in the workplace;
- participate in person or by proxy in the inspection and examination of issues related to the improvement of conditions, health and safety;
- refuse to work in the event of a situation which endangers his health or life, with a written notice to this supervisor or employer;

- education and training required for the safe performance of work duties, in accordance with the legislation of the Republic of Kazakhstan;

- obtain reliable information from the employer of the characteristics of the workplace and the territory of the organization, the state of the environment safety and safety, of the threat to life and health, as well as measures to protect it from harmful (extra harmful) and (or) hazardous production factors;

- maintenance of the average wage at the time of the suspension of the organization for its non-compliance with the occupational safety and health requirements;

- appeal against unlawful actions of the employer in the field of occupational safety and health.

The procedure for providing employees with special clothing, special footwear and other means of individual and collective protection, ablution facilities and devices at the expense of the employer, as well as the rules for issuance of milk to employees, healthful and dietary meals set by the order of the Minister of Health and Social Development of the Republic of Kazakhstan dated 28 August 2015 #697 “On approval of Rules of issue to employees of milk, preventive nutrition, special clothes, special footwear and other personal protective means, to ensure collective protection of employees, ablution facilities and devices at the expense of the employer”.

MLSP Order of 23.08.2007 # 203-p “On approval of rules for mandatory periodic qualification of facilities for the working conditions” sets the procedure for inspection of the workplace for the hygienic, sanitary and technical standards.

The procedure for training employees on occupational health and examination of technical safety knowledge is set by order of the Republic of Kazakhstan MLSP dated 23.08.2007 #205-p “On approval of Rules of training, coaching and knowledge checks of the employees on safety and safety”.

For the purpose of comprehensive assessment of working conditions at workplaces, reduction of workplace injuries and preventing accidents at work, the emergence of occupational and production-related diseases, the authorized state labor authority and

its territorial subdivisions organize continuous monitoring and risk assessment of occupational safety and health.

**Monitoring of labor protection** - systematic observation, analysis, evaluation and forecast of the state and dynamics of changes in results and working conditions in the workplace in order to reduce injuries and prevent accidents.

Maintaining safe working conditions in the workplace, compliance with the requirements of occupational health and industrial hygiene is provided by an internal control on health and safety of the enterprise.

To implement the internal control over compliance with labor and safety in industrial organizations with over 50 employees, an employer creates a health and safety service. By its status the labor or safety service ranks with the main production services.

Model regulation of health and safety in the organization is approved by the authorized state body for labor. An employer with fewer than 50 employees forms the post of health and safety specialist given the specific activities or responsibilities for health and safety imposes on other specialist. Instructions by health and safety service or health and safety specialist on health and safety requirements are binding on all employees of the organization.

Guarantees of the rights of employees on safety and health at the conclusion of the employment contract, in the course of employment are specified in RK Labor Code (article 317) as relevant duties of the employer in the field of occupational safety and health.

The employer must:

- take measures to prevent any risks in the workplace and in industrial processes by means of prevention, replacement of production equipment and processes to safer ones;
- provide training on safety and health of employees;
- carry out organizational and technical measures for occupational safety and health;
- provide briefings, provide documents for the safe conduct of the production process and work;
- undergo examination of knowledge on occupational health and safety and arrange testing knowledge of managers and specialists in accordance with the rules approved by the labor authority;

- create the necessary sanitary conditions for the employees, ensure repair of special clothing and footwear of employees, supply them with the means of preventive treatment, detergents and disinfectants, first aid kit, milk, therapeutic and preventive nutrition in accordance with the standards established by the authorized state body for labor;

- provide the authorized state labor authority and its territorial subdivisions, officials of the sanitary and epidemiological service bodies, employees' representatives at written request thereof, the necessary information of the status of safety, working conditions in organizations;

- fulfill requirements of state labor inspectors;

- register, account and analyze the accidents, occupational diseases;

- provide with the participation of employees' representatives periodical, at least once every five years, certification of production facilities for working conditions, as well as the compulsory certification after reconstruction, modernization, installation of new equipment or technology, in accordance with the rules approved by the state labor authority;

- ensure the investigation of accidents at work in accordance with the legislation of the Republic of Kazakhstan;

- underwrite liability for harm to the health and life of an employee in the performance of job duties;

- report cases of acute poisoning in the relevant territorial unit of the authorized state body in the field of sanitary and epidemiological welfare of the population;

- provide safe working conditions;

- Spend at its own expense required, periodic (within operation) medical examinations and pre-shift medical examination of employees as stipulated by the legislation of the Republic of Kazakhstan, as well as the transfer to another job with the working conditions changed or when the signs of occupational disease;

- take urgent measures to prevent the development of emergency and impact of injury factors on others.

Order of the Minister of Labour and Social Protection of Population of the Republic of Kazakhstan dated December 2, 2004 #

278-p approved the "Rules of development and approval of instructions on safety and labor protection in the organization". Under the rules of safety and health protection in the organization (hereinafter - Rules) - it is an act of an employer, detailing the implementation of legislation in the field of occupational health and safety when working in the industrial premises, industrial estates, construction sites, vehicles and other places of enterprise where these works or duties are performed.

Development of guidelines must be carried out by the employer for each occupation on the site, in the workshop, office, laboratory, and enterprise as a whole, and for certain types of work (working at height, tests, etc.) and working area, according to the list, which is developed by safety and health service or occupational health and safety specialist (hereinafter - responsible person) with the participation of heads of relevant structural units of the organization and the employees' representatives. The list is compiled as per staffing of an enterprise approved given the Standard Wage-Rates and Skills Reference Book of works and professions of employees and employees and the Competency Catalogue of servants. Compiled list is approved by the supervisor or other authorized person and sent to all structural units of the enterprise.

Development of instructions may also be carried out by specialists of scientific institutions in the field of health and safety on a contract basis at the request of the employer (enterprise).

According to the rules, guidelines must be developed as per laws and regulations of the Republic of Kazakhstan and industry standards for occupational health and safety with regard to the safety requirements set in the operational and maintenance documentation of equipment manufacturers, and in enterprise technical documentation of enterprises and production conditions. Reference to the laws and regulations in the instructions is not required, but if necessary the requirements of laws and regulations must be shown in the instructions.

Preparatory work needed for the development of instructions includes:

- ✓ studying technology process, identifying possible dangerous and harmful factors arising from its normal flow and deviations from

the optimal mode, as well as defining measures and means of protection from the same;

- ✓ determining compliance of applied equipment, appliances and tools with the safety requirements;
- ✓ selection of data on health and safety, which can be used in the development of instructions;
- ✓ studying design features and effectiveness of the remedies can be used in carrying out the relevant activities;
- ✓ studying information letters, instructions and orders of the relevant state authority on a result of accidents and fatalities at the enterprises of the industry;
- ✓ analyze the causes of occupational injuries, accidents and occupational diseases for the profession (type of work) in the enterprise;
- ✓ define safe methods and techniques of work, their sequence, as well as technical and organizational measures to be included in the instructions;
- ✓ define work and rest on the basis of approved standards.

Under the Rules each instruction must be assigned an appropriate title. Title must briefly indicate which profession or type of work it is designed for, for example, "Health and safety instructions for gas welder", "Health and safety instruction for working at height" and so on.

Instructions must include a brief description of the process and comprehensively cover matters of safe work organization. Instruction requirements must be presented in accordance with the sequence of the process, taking into account the conditions in which this work is carried out:

- 1) general requirements for health and safety;
- 2) health and safety requirements of before work commencement;
- 3) health and safety requirements at work;
- 4) health and safety requirements in emergency situations;
- 5) health and safety requirements at the end of work.

Section "General requirements for health and safety" present:

- ✓ conditions for the permission of persons to work independently by the profession, or to conduct of the relevant work (age, gender, health status, briefings);

- ✓ indication of the need to comply with internal regulations;
- ✓ requirements for the implementation of work and rest terms;
- ✓ features of dangerous and harmful production factors affecting the employee;
- ✓ regulations for issuing for the profession of special clothing, footwear and other personal protective equipment, with designation of government, industry standards and technical specifications for them;
- ✓ requirements for fire and explosion prevention assurance;
- ✓ personal hygiene rules that the employee must know and observe when performing work.

Section “Health and safety requirements before starting work” must set out:

- ✓ procedure for the preparation of the workplace, personal protective equipment;
- ✓ procedure for checks of equipment, appliances and tools, fences, alarms, blocked and other devices, protective grounding, ventilation, local lighting, etc.;
- ✓ procedure for check of the availability and condition of the raw materials (blanks, semi-finished products);
- ✓ procedure for accepting a shift in the case of continuous operation;
- ✓ industrial hygiene requirements.

The section “Health and safety requirements at work” must set out:

- ✓ methods and techniques for the safe performance of work, rules for the use of technological equipment, devices and instruments;
- ✓ Requirements for the safe utilization of raw materials (raw materials, blanks, semi-finished products);
- ✓ rules for the safe operation of vehicles, containers and hoisting devices;
- ✓ guidance on safe maintenance of the workplace;
- ✓ main types of deviations from the standard of technological modes and methods of their elimination;
- ✓ actions aimed at the prevention of accidents;
- ✓ requirements for the use of employees protection.

Section “Health and safety requirements in emergency” must set out:

- ✓ actions of employees in the event of accidents and situations that can lead to undesirable consequences;
- ✓ provide medical care to victims in injury, poisoning and sudden illness;
- ✓ procedure for reporting to administration of the enterprise of the cases of injury of employee and the failure of equipment, appliances and tools.

Section “Health and safety requirements at the end of work” must set out:

- ✓ the procedure for safe shutdown, stop, disassembly, cleaning and lubrication of equipment, fixtures, machinery, tools and appliances, and when a continuous process - the procedure for the transfer of the shift;
- ✓ procedure for handing-over of the workplace;
- ✓ procedure for cleaning waste products;
- ✓ Requirements for personal hygiene and industrial health;
- ✓ procedure for reporting to the head of all the shortcomings detected during operation.

Instructions are approved by the employer (the head) after consultation with the health and safety service or the responsible person and other relevant structural units, officials and employees of the enterprise. Approved instructions are taken into account by health and safety service or the responsible person of the enterprise in the register of health and safety instructions.

Enterprise health and safety service or responsible person in accordance with the Rules must continuously monitor the timely development, audit and revision of the instructions, provide methodological assistance to developers, assist them in familiarization with the laws and regulations of the Republic of Kazakhstan and the industry safety and health regulations and current standards.

Issuing instructions to heads of divisions (services) of enterprise is made by health and safety service or the responsible person with the registration of their issuance in the instructions register. Under the Rules the instructions are issued to employees for review against receipt in a personal induction card, and posted in the

workplace or any other place accessible to employees. The head of division (service) of enterprise must keep a set of division (service) instructions in effect for employees of all professions and for all kinds of work of this division (service), as well as a list of instructions approved by the head of the enterprise. Each site supervisor (master, foreman and so on.) must have a set of instructions for employees engaged in this site, by all professions and types of work.

Revision of instructions on professions or types of work associated with increased risk must be conducted at least once every 3 years. If within this period no working conditions of employees of the enterprises change, then the effect of instructions is renewed for the next period, whereof an entry on the first page of instructions (stamped "Revised", date and signature of a person responsible for reviewing the instructions) is made. Instructions are subject to early review in the cases as follows: 1) changing the legislation, state standards and other laws and regulations of the Republic of Kazakhstan; 2) the introduction of new techniques and technologies; 3) the results of the investigation of personal injuries at work, accidents and disasters.

On the results of review the need to make changes and additions to the instructions is determined.

Order of the Minister of Labour and Social Protection of Population of the Republic of Kazakhstan dated August 23, 2007 # 203-p approved the "*Rules for conducting mandatory scheduled qualification of industrial facilities with respect to working conditions*" (hereinafter - the Rules).

In accordance with the Rules qualification of industrial facilities with respect to working conditions may be carried out by: the employer having in its enterprise the health and safety service and laboratory for laboratory and instrumental studies of industrial environmental factors, or by a designated enterprise. Besides all the facilities of enterprises operating in the territory of the Republic of Kazakhstan are subject to this qualification. Control over the timeliness and quality of the qualification of production facilities is carried out by state labor inspectors.

**Qualification of production facilities** includes: the qualification of each of the jobs of enterprises, except for jobs associated with the permanent stay of employees in the open air, in accordance with the current regulations of conditions and safety of work and a comprehensive assessment of production facilities of the enterprises for their compliance with conditions and safety of work.

According to the Rules, the dates of the qualification conduct is established by the enterprise on the basis of changes in working conditions, but not less than once every 5 years since the last qualification of production facilities.

The extraordinary qualification of production facilities shall be carried out in cases of reconstruction, modernization, installation of new equipment or technology; at the request of the body of state supervision and control of health and safety in case of discovery of violations of the qualification methodology on conditions of work.

For the arrangement and conduct of qualification of production facilities the employer issues relevant order on the establishment of the qualification commission consisting of the chairman, members and secretary responsible for the preparation, maintenance and storage of documents of production facilities qualification. The qualification commission is composed of the head of the enterprise or his deputy, health and safety service specialists and other departments in consultation, as well as health employee and representatives of enterprises employees.

Enterprise qualification commission, according to the Rules: compiles a list of production facilities, shops, sites and other workplaces, as well as dangerous and harmful factors of the working environment subject to be survey (to lab tests and evaluation), based on the characteristics of the labor and technological processes, used species of equipment and machinery, raw materials, and submit them to the employer for approval. Prepare and submit to the employer for approval a qualification schedule of production facilities of the enterprise; assigns codes to productions, workshops, sites, workplaces for the automated processing of the results of workplaces qualification with regard to working conditions; generates the necessary regulatory and reference framework for the qualification of production facilities. It analyzes the causes of industrial accidents and occupational diseases; determines the most hazardous operation,



areas of jobs, technology, machinery, tools and equipment based on an analysis of occupational injuries. In the absence of self-empowerment for the qualification of production facilities defines a specialized enterprise, the laboratory for laboratory and instrumental studies in the industrial environment and working conditions and the employer makes an offer to conclude an appropriate agreement with her. Coordinates with attracted a specialized enterprise and the employer dates of certification of production facilities taking into account the scope of qualification; provides assistance to the laboratory in studying the environment factors, workplaces, facilities, oversees the qualification of production facilities.

Qualification includes: assessment of the hazards and risks of labor; assessment of the extent of injury; evaluation of production equipment, devices and instruments; evaluation of professional training of personnel; assessment of equipping of employees with personal protective equipment.

All existing workplace hazardous and harmful production factors (physical, chemical, biological), including the severity and intensity of work are subject to assessment with regard to working conditions. Levels of dangerous and harmful production factors are determined on the basis of laboratory and instrumental measurements. Laboratory and instrumental measurement of physical, chemical, biological and psychophysiological factors and ergonomic studies must be carried out in the working conditions and production processes in accordance with the technological regulations, with serviceable and effective means of collective and individual protection. Measurements of parameters of dangerous and harmful factors, the determination of indicators of severity and intensity of the labor process, hygienic examination of working conditions in production are carried out in the manner and in the amounts stipulated by the laws and regulations, sanitary rules and codes, state standards.

Evaluation of the actual state of working conditions, according to the rules, must be carried out in accordance with the hygienic criteria of evaluation and classification of working conditions in terms of hazards and risks in the industrial environment, the severity and intensity of the work process P 2.2.755-99 (registration number ADZ RK # 1.04.001.2000).

When measuring parameters of harmful and hazardous production factors it is necessary to use measuring equipment (gas analyzer, vibration meter, dosimeters and other devices) that have passed the state verification, in accordance with established deadlines. When measuring one must follow the mandatory quality control procedures.

Results of laboratory, instrumentation and ergonomics research must be registered in minutes in accordance with the forms of medical documentation.

The main objects of injury assessment are: production equipment; tools and instruments; provision with means of training and briefing; trained staff; knowledge of personnel of safety regulations, occupational health and industrial hygiene.

Evaluation of the production equipment, devices and tools is performed based on existing laws and regulations on occupational safety and health, government and industry standards, rules and regulations on occupational safety and health, and depends on their technical condition, compliance with the passport parameters and requirements of the production process technology.

Assessment of the risk of injury is conducted by checking the conformity of production equipment, devices and tools, as well as means of training and instruction requirements of laws and regulations, subject to the certificates for industrial equipment.

In accordance with the Rules in case of missing a certificate for certain types of equipment and machinery, regardless of their technical condition, a negative evaluation of work safety is given and the need for the suspension of their operation is considered.

In assessing the safety of the production process and equipment for injury free operation one must conduct trial starts and stops of production equipment with meeting safety requirements.

Assessment of professional training of **personnel** is determined by the availability of appropriate education and compliance with the qualification requirements for the profession.

When evaluating the equipping of employees with personal protective means for each workstation is determined equipping of employees with personal protective equipment (PPE). Evaluation of PPE furnishing of employees is determined by comparing the actual disbursed funds to the rates of free issue to employees of special

clothing, special footwear and other personal protective equipment, taking into account the impact of harmful factors of the industrial environment. In assessing the sufficiency of PPE equipping of employees simultaneously a compliance of issued PPE with actual state of working conditions in the workplace is assessed. Efficiency and quality of personal protective equipment must be supported by manufacturer certificates of conformity. Evaluation of provision of PPE to employees is formalized by report of assessing provision of PPE to employees. In case of complete provision of PPE to employees only an assessment "equipped" is made.

Evaluation results must be documented in a single document including the mandatory sections and containing a mandatory application.

According to the Rules, according to the results of qualification of production facilities Qualification Commission must develop action plan for the improvement and sanitation of working conditions in the enterprise. It must provide for measures to replace obsolete machinery and equipment, improve the technology of the production process, use of appropriate working conditions of individual and collective protection, recreational activities and activities for the enterprise's health and safety, as well as bringing all workplaces in compliance with health and safety requirements.

### **3.1. Considerations of labor regulation of specific categories of employees**

In the legislative provision of labor regulation of specific categories of employees, one takes into account not just social peculiarities but also medical and biological ones of the organism of the working population. During the justification of the scientific foundations of labour rating, biological, anatomical and physiological, biochemical, immunological and other features of the human body are extremely important [24, 25].

As is known under ontogenesis, individual human life is accompanied by a phased, multilateral, differentiated development of individual organs and body systems. Childhood is described by completing development of the endocrine system and, in particular,

of reproductive function. A balanced relationship between the two coordinating systems of the body - the nervous and endocrine – is formed.

Significant gender differences in stress of physiological functions drive the need to integrate these features in the design of appropriate hygienic standards, which relate primarily to the factors of production environment and labor process. Thus, women are characterized by a lower efficiency and productivity, early fatigue and overwork, a significant incidence of reproductive health when working with significant physical activity, as well as in terms of adverse effects of chemical, physical and biological factors that is the basis for legislative regulation of female labor characteristics [26, 27].

The female body's reaction to the impact of harmful factors tends to be more significant than that of men. Increased reactivity of the female body to the unfavorable factors of working conditions depends on the anatomical and physiological features. Given that muscle strength and endurance of women is 20-30% less than that of men, all sorts of physical overload lead to diseases of the musculoskeletal system and the peripheral nervous system. For the female body the factors of the production environment, where the action of chemicals, vibration, noise, non-ionizing and ionizing radiation prevails are very unfavorable.

Anatomical and physiological capabilities of the cardiovascular, respiratory and muscular systems of both women and men, and people of adolescence vary considerably, so the development of measures for health protection of women and employees under the age of eighteen years, based both on common methodological basis of medical and biological requirements, in regard to working conditions, and on specialized physiological and hygienic approaches due to the biological and physiological features of female and growing organisms.

It is well known that only by eighteen years comes the final formation and maturation of organs and body systems of adolescents. Features of muscle strength and endurance of teenagers aged 16-18 make up 80% from those of adults, and the recovery period after strenuous exercise is delayed in adolescents by 30% compared with adults. Intense noise, vibration, exposure to electromagnetic fields

has a very adverse effect not only on the hearing organ, but the cardiovascular, central nervous, endocrine and other systems. Young body is very sensitive to the exposure of chemicals and dust.

Problems of labour rational use of older age groups, employees engaged in heavy work or work under harmful and hazardous working conditions, working in shifts, disabled persons labor require solutions not just of socio-economic and health-care issues, but also creating an adequate legal framework. In maintaining the health of this community, providing their high performance and longevity of their employment, the optimal regulation of labor activity - scientific substantiation of work and rest, observance of ergonomic requirements for manufacturing equipment, as well as the introduction of the whole set of health measures in the workplace are important.

### **Regulation of labor of under-18s employees**

Employees who have not reached the age of eighteen years in an employment relationship have the same rights as adults, but in the field of occupational safety, working time, rest periods and other conditions there are additional guarantees established by this Code.

**Minors** - persons who have not reached the age at which the law binds the offensive capacity. Minors have a part-time capacity. Under the legislation of the Republic of Kazakhstan the minors are persons under 18 years of age.

**Diminished capacity**- partial capacity, where a citizen has the right, with its acts, to commit not any legitimate action, but only a few expressly specified in the law.

Minors have diminished legal capacity, which scope of authority directly depends on their age. The civil legislation of Kazakhstan distinguishes between two groups of such persons:

- Minors between the ages of 14 and 18;
- Tweens under the age of 14 years.

The legitimate interests of minors (wholly or partly) are presented by their parents, other legal representatives, guardians, trustees. The laws provide for a number of measures specifically protecting labor, civil, alimony and other rights of minors. In criminal proceedings, a special procedure of consideration of cases of

minors, providing the most thorough investigation and consideration, is established.

A minor who has reached the age of sixteen, may be declared fully capable if he works under an employment contract or with the consent of parents, adoptive parents or guardians.

Declaration of a minor as fully capable (emancipation) is made by decision of the guardianship authority with the consent of both parents, adoptive parents or guardian or, in the absence of such consent, by court order.

Emancipated minor has civil rights and obligations (including obligations arising from causing harm to it), except those rights and obligations for the acquisition of which the legislative acts of the Republic of Kazakhstan set the age limit.

The parents, adoptive parents and guardians must be liable for no obligations of an emancipated minor.

The ability of their actions to exercise their rights and carry out duties in court, charging case management representative (civil procedural capacity) belongs fully to citizens who have reached the age of eighteen, and enterprises.

The rights, freedoms and lawful interests of minors under the age of fourteen to eighteen and those not reached the age of fourteen, are protected in court by their parents or other legal representatives with mandatory participation in such cases of minors themselves.

**Utilization of labor of under-18s employees is prohibited** in heavy work or work under harmful (extra harmful) and (or) hazardous working conditions, as well as in work which performance might be detrimental to their health and moral development (gambling, work in night entertainment venues, production, transportation and sale of alcoholic beverages, tobacco products, narcotic drugs, psychotropic substances and precursors).

Carrying or handling by under-18s employees of weights exceeding the limits established for them is forbidden.

List of works for which the use of under-18s employees is prohibited the limits and carrying heavy loads by under-18s employees are determined by the state labor authority on agreement with the state healthcare authority.

The list of heavy jobs and jobs with harmful or hazardous working conditions for which it is prohibited to employ the under-18s

employees is approved by the Order of Minister of Health and Social Development of the Republic of Kazakhstan dated May 27, 2015 # 391 “On approval of the list of works, for which is prohibited employment of under-18s employees, the marginal rates of carrying and handling of load by under-18s employees and a list of jobs for which is prohibited the employment of women, the marginal rates of lifting and manual handling of loads by women”.

The employment of under-18s persons for the works included in the List is prohibited for all employers, regardless of the sectors of the economy, as well as the legal form of legal entity and ownership.

Under-18s persons cannot also perform a work:

- bywork, according to art.200 TC RK;
- By a written contract of full liability, according to art.184 TC RK;
- On a rotational basis, according to st.211 TC RK.

Under-18s persons are set the following limits for carrying and handling heavy loads according to the Order of Minister of Health and Social Development of the Republic of Kazakhstan dated May 27, 2015 # 391 “On approval of the list of works, for which is prohibited an employment of under-18s employees, the limits of carrying and handling load by under-18s employees, and a list of jobs for which is prohibited an employment of women, the limits of lifting and handling loads by women”.

Employees (persons) who have not attained the age of eighteen (hereinafter - the teenagers) must not be assigned for a job consisting exclusively of carrying or handling heavy objects weighing over 4.1 kg.

Carrying and handling heavy loads by teenagers of both genders within the following rates is permitted only in cases when they are directly connected with the performance of teenager continuous professional job and not take up over one third of their working time.

With employees who have not reached eighteen years of age, employment contracts are concluded only after a compulsory preliminary medical examination. Then, employees until reaching eighteen years are subject to mandatory annual medical examination.

**Table No. 3.** Limits for carrying and handling loads by under-18s employees, taking into account the weight of the container, packaging and accessories.

#	Job description	The maximum allowable load weight, kg
1.	Carrying heavy loads: 1) for male adolescents aged 16 to 18 2) for female adolescents aged 16 to 18	16.4 10.25
2.	handling heavy loads on trolleys on rails: 1) for male adolescents aged 16 to 18 2) for female adolescents aged 16 to 18	492 328

For employees aged 14 to 18 is set shorter working hours, as follows:

- From fourteen to sixteen years - no more than 24 hours per week;
- From sixteen to eighteen years - no more than 36 hours per week.

Persons under eighteen years of age are not allowed to work at night and overtime work. Labor rate for employees under eighteen shall be established on the basis of workload standards for adult employees in proportion to the reduction of working hours for persons under eighteen years.

The employer is required to keep a written record of the working time individually for each child worker.

### **The work, which is prohibited for women**

Special protection of women's work begins from the moment of acceptance them to work.

The employment of women in heavy work or work under harmful (extra harmful) and (or) hazardous working conditions is prohibited.

It is forbidden to lift and handle heavy loads manually by women, exceeding the limits established for them.

The list of jobs which is prohibited for the employment of women, limits for manual lifting and handling heavy objects by women is determined by the state labor authority on agreement with the state healthcare authority.

The list of jobs which is prohibited the employment of women and limits of lifting and manual handling of loads by women is established by the Order of the Minister of Health and Social Development of the Republic of Kazakhstan dated May 27, 2015 # 391 *“On approval of the list of works, for which it is prohibited the employment of employees who have not reached eighteen years of age, the labor rate of carrying and handling of loads by under-eighteen employees, and a list of jobs for which is prohibited the employment of women, the labor rates of manual lifting and handling heavy objects by women”*.

In addition, women must undergo preventive medical examinations according to the *“Instructions for preventive medical examinations of specific categories of adult population by sample (screening) examinations”* approved by the Order of the Republic of Kazakhstan Minister of Health of October 15, 2007 # 607 *“On improvement of preventive medical examinations of certain categories of adult population”*.

The above legal documents and the relevant sanitary rules and standards regulate the working conditions of women which apply to individuals and legal entities of all ownership forms utilizing the work of women, and determine the requirements for the production and labor processes, equipment, workplaces, the work environment and sanitary domestic provision of working women.

**Table No. 4.** Limits of manual lifting and handling by women of loads must not exceed:

#	Description of work	Max.allowable load weight
1.	Lifting and handling (single) weights in alternation with other work (Up to 2 times per hour)	10 kg
2.	Lifting and handling (single) weights continuously during the work shift	7 kg
3.	The value of the dynamic work done during each hour of the work shift when handling cargo over a distance of 1 to 5 meters must not exceed: - from the working surface - from the floor	1750 kgm 875 kgm

*Notes:*

1. The weight of lifted and handled load includes the weight of packaging.
2. When moving loads on trucks or containers the force applied must not exceed 10 kg.

**Features of work and rest mode for women and others with family responsibilities**

The employer is not entitled to engage pregnant women to work at night, work on weekends and public holidays, overtime, to send them on business trips, as well as to recall them from annual paid leave.

The employer is not entitled to engage in night work, overtime work, and also to send to a mission and the work being done on a rotational basis, without their written consent, as well as women with children aged up to seven years, and others with children in aged up to seven years without a mother.

Labor Code of the Republic of Kazakhstan prohibits involvement to the above types of work of employees caring for sick family members or children with disabilities, if on the basis of a

medical opinion, children under three years, disabled children or sick family members are in need of constant care.

Women with children under the age of seven may be sent on business trips, to work overtime, work at night, weekends and public holidays only subject to their written consent and a medical report allowing the change of working conditions.

The above personnel shall be familiar with their rights, and in case of disagreement to perform the job, quit it in writing.

The refusal of a pregnant woman (upon pregnancy discovery), mothers with children up to the age of three, as well as employees with family responsibilities mentioned above from night and overtime work, work on weekends and public holidays, business trip is not a disciplinary offense and violation of the labor contract.

Apart from a break for rest and meals, intra-shift and special breaks, women with children under the age of one and a half, fathers (adoptive parents) with children under the age of one and a half without a mother, are provided with additional breaks for feeding the child (children) at least every three hours of work with duration as follows:

- having one child - each break of at least thirty minutes;
- having two or more children - each break of at least one hour.

Breaks for feeding a child (children) at the application of an employee are combined to a break for rest and meal breaks or summarized breaks are provided at the beginning or end of the working day (shift).

Breaks for feeding a child (children) are included in working time. During the breaks for women (fathers, adoptive parents) the average wage is maintained.

Breaks for breastfeeding are provided for working women, mothers and working fathers bringing up children without a mother, and guardians. Providing break does not depend on whether baby up to one and a half years is breastfed or bottle-fed.

Nursing breaks are provided to the woman if she uses maternity leave. If another member of the family actually caring for the child is on vacation, this does not deprive the mother the right to take a break.

Breaks for feeding a child are provided at least every three hours. Therefore, the 8-hour work shift and at the 7-hour working day two breaks are provided for feeding a baby. One break for breast-feeding is available with 6-hour working day with or without lunch break.

The duration of each break cannot be less than 30 minutes. If a working woman has two or more children under the age of one and a half years the duration of the break for feeding is set at least one hour. Thus, these breaks actually reduce working hours, while maintaining a payment for full-time. Longer breaks may be provided for by the collective agreement, the agreement, local laws, the employment contract.

In cases where a woman cannot use the provided break to feed the baby, then it is allowed to:

- incorporate a break for feeding to a break for rest and meal;
- integrate breaks and in summary to make a break at the beginning or at the end of the working day (work shift) with a corresponding reduction thereof.

### **Features of regulation of labor of employees engaged in heavy work, work under harmful (extra harmful) and (or) hazardous working conditions**

For employees engaged in heavy work or work under harmful (extra harmful) and (or) hazardous conditions of work, the shorter working hours of more than 36 hours a week are set.

List of productions, workshops, professions and positions, as well as the list of arduous jobs, jobs under harmful (extra harmful) and (or) hazardous working conditions, labor in which entitles to a reduced working time determined by the state labor authority on agreement with authorized state body in the field of public health.

Reduced working hours not exceeding 36 hours per week are established for this category of employees by the order of acting Minister of Labour and Social Protection of Population of the Republic of Kazakhstan of July 31, 2007 # 182-p “*On Approving the*

*List of production facilities, workshops, professions and positions, list of arduous jobs, jobs under harmful (extra harmful ) and (or) dangerous working conditions, work in which entitles to reduced working hours and additional paid annual leave, and Instructions on its use”.*

The duration of reduced working hours established by the List can be reduced on the basis of qualification of production facilities of enterprises, carried out in accordance with the order of the Minister of Labour and Social Protection of the Republic of Kazakhstan dated August 23, 2007 # 203-p “*On approval of Rules for mandatory periodic qualification of industrial facilities for working conditions*” and taking into account the actual state of working conditions in the workplace.

The exact duration of the reduced working time is established as the norm in the collective agreement and labor contract.

In the case of the failure of the employer to qualify production facilities of enterprise with regard to working conditions, reduced working hours are provided in full as set for in the List.

Employees, which professions and positions are provided for in the section of the List “*General professions of all sectors of the economy*”, reduced working hours are provided no matter in what industries or shops they work if these professions and positions are not expressly provided in the relevant sections or sub-sections of the List.

Reduced working hours according to the specified in the List are established only to employees in the days when they are engaged in hazardous working conditions over half of the working day established for the work of the production, shop, profession or position.

Employees of other enterprises and employees of auxiliary shops of enterprises during their work in existing industries and shops with harmful working conditions, where for both key employees and repair and maintenance personnel of these productions and workshops are set reduced working hours in the same order.

Additional annual paid leave is granted to employees in accordance with the list of productions, workshops, professions and positions, as well as the list of arduous jobs, jobs under harmful

(extra harmful) and (or) hazardous working conditions, work in which entitles to an additional annual paid leave (order of acting Minister of Labour and Social Protection of Kazakhstan of July 31, 2007 # 182-p). The duration of this type of leave, as well as the conditions of its provision must be determined by the state labor authority on agreement with the state healthcare authority. Meanwhile, this Order details the conditions of provision to these employees not included in the list, but worked in a separate time periods in harmful working conditions, with additional leaves.

### **Features of regulation of labor of seasonal employees**

**Seasonal work** - is a category of jobs that due to climatic or other natural conditions are performed within a certain period (season), but not more than one year.

List of industries, work in which can be attributed to seasonal one is set by the Resolution of the Government of December 1997 # 1679 “*On approval of the list of seasonal industries, work in which over a full season is included in the seniority for a pension as a year of work, and the list of works the execution of which shall be counted to certain categories of health employees in health facilities as seniority for assigning a pension as a time-and-a-half rate*”.

Seasonal work, as a rule, includes agricultural activities (crop, harvesting of agricultural products), field expeditions, the extraction of precious metals and precious stones, timber harvesting, timber rafting, afforestation and reforestation, production of milk and meat, fishing and extraction of seafood and their processing, sugar production, fruit and vegetable preserves and others.

In addition, based on the definition of seasonal work, the employer may independently determine the list of works related to them.

The employment contract shall specify the condition of signing a contract for seasonal work, and a certain period of their implementation. When entering into an employment contract for seasonal work no trial period in order to verify compliance of the employee with a job being assigned to it is established.

### **Features of regulation of work of employees, working under rotational system**

**Rotational system** is a special form of the labor process outside the place of permanent residence of employees, when a daily return of them to their permanent place of residence cannot be provided.

The employer must provide for to employees working in rotational basis during their stay at the production facility with housing to ensure their livelihoods, transport to the place of work and back, as well as the conditions for work and rest between shifts.

The employer provides to the employee with conditions of stay at the production facility in accordance with the labor and collective contracts.

There are two kinds of rotational system: *normal rotational and rotational and expeditionary*.

- Normal rotational method is featured by short (usually within one area) movements of personnel, a small rotation duration, availability of transportation and communication between the base settlements and field camps, fixed administrative apparatus and a permanent place of residence of employees in the area of production activities of the employer.

- For rotational and expeditionary method has a feature that rotation camps are located at a considerable distance from the place of residence of employees and of the employer, the duration of rotation is up to several months, after rotation entire staff of primary production is usually replaced, i.e. shift work is organized. Working on rotation basis, although is connected with regular trips outside the place of residence, is not a business trip.

The use of the rotation method is aimed at reducing the time of construction, repair and reconstruction of industrial, social and other purposes in remote areas or areas with specific natural conditions, as well as for the implementation of other productive activities (e.g. exploration, oil production, fishing, etc.).

Rotational method is widely used in oil, gas and timber industry, in construction, geology, agriculture and water management and other industries.

One cannot regard a rotation as travel inducement, as the term "*travel inducement*" refers to the execution of works on objects

located at a considerable distance from enterprise location, for travel during off-hours from the location of the enterprise (assembly point) to the place of work on the site and back.

For example, the enterprises performing such activities include repair and construction companies; portable mechanized columns and other construction companies engaged in the construction, reconstruction, repair of highways and communications (railway lines, pipelines, roads, cable, radio-relay and air lines of communication, overheads and cable power lines), objects and facilities necessary for setting up oil and gas fields; enterprise serving facilities of agriculture and water management, water supply and gas supply; tunnels, bridges, structures, sea and river transport, airports and aerodromes; timber and forestry enterprise.

Employer costs for hiring of accommodation and meal within the per diem established for the payment of travel to ensure the livelihoods of people working on rotational basis, during their stay at the manufacturing facility with the provision of conditions for work and between shifts recreation, as well as costs associated with employees' delivery from their place of residence in the Republic of Kazakhstan to the place of work and back, are deductible from the total annual income (TAI) and are not income of employees.

However, if the employer pays the delivery of non-resident employee from the place of residence (outside the territory of the country) to the place of assembly point, then such costs relate to the non-resident employee's income.

Given that the watch has the essential features that are different from the usual work of the enterprise, it is desirable to employers to develop and approve the Regulation "*On the arrangement of work in rotation*" and be guided by it in the works related to the rotation.

Rotation camps organized by the employer for this form of work are a complex of residential, cultural and social, health and economic buildings and structures intended for life support to employees working on rotational basis, during their rest in rotation, as well as maintenance of construction and special machinery, vehicle, storage of stocks of inventory.



The employer on its own and at its own expense solves the matters of catering, leisure and recreation, health, trade, household and cultural services of resident employees and service personnel.

Transport of employees to rotation is carried orderly from the location of the enterprise or from the assembly point to the place of work and back by cost-effective means of transport on the basis of long-term contracts with transport companies. For transporting staff trucks may be used equipped to transport people and belonging to the enterprise applying the rotational method.

Travel of employees from their place of residence to the assembly point and place of work (facility, site) and back is paid by the employer.

Given that employees at a rotational basis for a sufficiently long time temporarily reside in the production facility, which are used more heavy duty work conditions, as well as less favorable recreational facilities in comparison with those of the general rules, the ban on involvement in the work performed on rotational basis of certain categories of employees is set. Such works cannot employ employees under the age of eighteen, pregnant women and people with disabilities.

The employer according to art.187 TC of Kazakhstan is not entitled to involve in the rotational work without their written consent:

- Women with children aged up to seven, and others with children aged up to seven without a mother;

- Employees who take care of sick family members or children with disabilities, subject to a medical opinion, children under three years old, disabled children or sick family members in need of constant care.

Rotation is the period including the execution of works on the facility and the time between shifts recreation.

The duration of the rotation cannot exceed thirty calendar days.

## **Features of labor regulation of domestic employees**

**Domestic employee** - this particular group which job activity is based on a special trust relationship of employer and employee in the performance of work in the household with the employer, documented by the employment contract.

Domestic employees are recognized as employees carrying out work (services) in the household of employers - individuals.

Publication of an act of employment or termination of employment with the domestic employee and the entry of information on its work in the work book is not made by the employer.

Domestic employee labor activity is confirmed by the employment contract.

Dates for written notice of termination of the employment contract with an domestic employee, as well as cases and the size of the compensation payments in connection with loss of work are established by the labor contract.

According to the Civil Code of the Republic of Kazakhstan such employees can be attributed to the group of unskilled employees, i.e. service employees, housing and communal services, trade and related activities (domestic helpers and cleaners of apartments, governesses and tutors, maids, matron of hotels and inns, laundresses and manual ironers, providing in-home services, etc.).

Generally, in the practice the labor contracts with such categories of employees are not concluded, but in this case the employee does not fully guarantee to receive payment and in the event of a conflict to have the right to judicial protection, or a contract is signed for the provision of services, bearing the civil nature of the relationship which is regulated by the Civil Code of the Republic of Kazakhstan dated 27.12.94, #269-XII and dated 01.07.99 #409-I. But it would be correct and secure for employees if an employment contract in accordance with Article 32 of the Labor Code of the Republic of Kazakhstan is concluded and the deal is confirmed at the notary.

## Features of labor regulation of outworkers

*Outworkers* – are the persons who conclude an individual labor contract with the employer for carrying out the work at home with their own labor and materials using their equipment, tools and accessories, or those allocated by the employer or purchased at the expense of the employer.

Such persons, in particular, are persons in need of greater social protection, which for various reasons cannot work in the structural units of the enterprise. This group may include:

- Women with children under the age of fourteen (or disabled children under the age of eighteen);
- disabled and old-age pensioners;
- persons with reduced working capacity, who are recommended a work at home; who take care of the disabled, and other family members in need of care;
- persons performing the duties of telephone controllers, advertising agents, translators, typists, editors, authors, etc.;
- persons having skills of manufacturing folk arts and crafts, souvenirs and original packaging for them, and others.

Outworkers are sufficiently large informal sector of the labor force in the labor market that have all the rights of employees established by the TC RK. However, the lack of labor contracts allows individual employers discriminatory labor policies. At the same time, with the consent of both parties, an employment contract may be drawn up, which can regulate: working time and rest time, especially for the control of the employer's compliance with the employees working time, the conditions of health and safety. Compliance with these conditions for employees, who perform work at home, is determined in the employment contract. Outwork may be performed only in cases when they are not contraindicated for employee on health reasons and for their implementation the safety and health requirements can be ensured.

Outworkers are also prohibited to carry out such work, which create inconvenience for the neighbors living (for example, the work associated with high noise levels, vibrations, pollution, etc.).

## Labor regulation of disabled persons

Persons with disabilities have the right to conclude labor contracts with employers to conventional working conditions or specialized enterprises employing people with disabilities, taking into account the work of individual rehabilitation programs.

Failure to conclude an employment contract, the transfer of the disabled to other job, the change of working conditions on the grounds of disability are not allowed, except in cases where under the conclusion of the authorized state body in the field of social protection of the population the state of his health prevents the fulfillment of job duties or threatens his health and (or) the safety of others job.

*Disabled person* – is a person who has health problems with persistent disorder of body functions, caused by diseases, injuries, and their consequences, defects, which leads to a limitation of life and the need for their social protection.

*Social rehabilitation* – is a complex of measures aimed at creating conditions for overcoming disabilities, the restoration of social status, their social and environmental adaptation.

*Individual rehabilitation program* – is a document defining the specific amounts, types and timing of the rehabilitation of the disabled.

People with disabilities in the Republic of Kazakhstan have the full social, economic and personal rights and freedoms embodied in the Constitution of the RK and the Law of the Republic of Kazakhstan dated April 13, 2005 #39-III “*On social protection of disabled persons in the Republic of Kazakhstan*”.

The employer is obliged to create conditions for people with disabilities access to industrial buildings, structures, premises by the design and adaptation of workplaces and working premises, equip premises with special tools and devices in accordance with the individual rehabilitation program.

Failure to conclude an employment contract or refusal to promote, dismissal by the employer, the transfer of the disabled to another job without his consent on the grounds of disability are not permitted, except in cases where under the conclusion of the territorial authorized body unit in the field of social protection of

population the state of his health obstructs the performance of professional duties or threatens the health and safety of others job.

People with disabilities tend to create public associations that help them in finding employment. For example, in Kazakhstan there are two societies: Kazakh Society of the Blind and Kazakh Deaf Society, which enterprises employ over 4 million people with disabilities.

*The working conditions of employees with disabilities.* Terms of rating, payment and labor protection, working hours, the order of combining professions (positions), technical, sanitary, hygienic, production and living conditions, as well as other as agreed conditions of employment, collective agreements may not worsen the position, or restrict the rights of employees with disabilities compared with other employees.

It is forbidden the use of disabled persons in arduous work or work under harmful (extra harmful), hazardous working conditions.

Disabled employees can be granted additional guarantees set by this Code, agreements, and acts of the employer, as well as employment, collective agreements.

Medical reports of the part-time work, of reducing the workload and other working conditions of disabled employees are mandatory for execution by the employer.

For the disabled of first and second groups is set the shorter working time - no more than thirty-six hours a week, with additional annual paid leave of up to fifteen working days.

Work during the night under the consent of the disabled and provided that such work is not prohibited to him for health reasons.

The use of disabled employees in arduous job or job under harmful (extra harmful), hazardous working conditions is not permitted, even with his consent.

Employees with disabilities of first and second groups are set shorter working time - no more than 36 hours a week.

The duration of daily work (work shift) of disabled employees of first and second group cannot exceed seven hours.

## **Labor regulation of employees of small businesses**

Features of labor regulation apply to small businesses with an annual average number of employees not more than 25 people.

Small businesses are:

- Individual entrepreneurs without a legal entity with annual average employee number not more than fifty persons;
- Legal entities engaged in private enterprise, with an annual average number of employees not more than fifty persons, and the average cost of assets per year not exceeding sixty thousand-fold minimum calculation index (MCI).

Average number of employees of small businesses is determined by taking into account all employees, including employees of branches, representative offices and other separate divisions of the entity.

Entities of small business may conclude according to TC of Kazakhstan employment contracts with employees for a certain period without limitation; for a specified period not less than one year; for a period of less than one year - for the duration of a particular job at a time of replacement of a temporarily absent employee for the duration of the seasonal work.

Small businesses approve labor schedule rules on their own.

Given that the employer and the employee carry out labor activity within the right margin as defined by the legislation of Kazakhstan and to prevent potential conflicts between them and with the regulatory authorities, it is desirable to describe basic working conditions, including work schedule, in the employment contract, if the number of employees is small - 2-5 people or the regulation "On Staff", if their number reaches 25 people.

Small businesses have the right to set the operating mode, providing for the involvement at the weekend and on public holidays according to the schedule, which is approved by the employer, as well as the use of cumulative time tracking or division of the day into parts subject to meeting the general requirements for working hours.

The legislation of the RK concerning the occupational health and safety must necessarily be met at the facilities belonging to small businesses, to the extent required by activity and the number of

employees involved in the production of goods, performance of works or rendering services. Implementation of works on creation of safe working conditions can be carried out in-house, as well as by experts of other enterprises.

**Social partnership** - the system of relationships between employees (representatives of employees), employers (representatives of employers), state authorities, aimed at ensuring the coordination of their interests in the regulation of labor relations and other relations directly connected with them.

Social partnership serves as a way of reconciling the interests of employees and employers in the search for compromise solutions, resulting in social and labor. Social partnership allows most effective addressing the issues of social peace, maintaining an optimal balance of interests of employers and employees, the establishment of civil society stability.

The main principles of social partnership are:

- authorization of the representatives of the parties;
- equality of the parties;
- freedom to choose the issues discussed;
- voluntary commitments;
- respect the interests of the parties;
- mandatory performance of collective contracts and agreements;
- responsibility of the parties and their representatives for failure to perform obligations under the agreement by their fault;
- assist the state in strengthening and development of social partnership;
- transparency of decisions.

The principles of social partnership creates a framework for the regulation of relations between employees, employers and state authorities, local governments, determine the future development of the social partnership.

**Bodies of social partnership.** Social partnership is provided in the form of cooperation between the parties through social partnership bodies:

- at the national level - the Republican tripartite commission on social partnership and regulation of social and labor relations (hereinafter - the Republican Commission);

- at branch level - branch commissions for social partnership and regulation of social and labor relations (hereinafter - the branch commission);

- at the regional level (region, city, district) - regional, city and district commissions for social partnership and regulation of social and labor relations (hereinafter - the regional commission);

- at the level of enterprises in the form of agreements or collective agreements establishing specific mutual obligations in the field of labor between representatives of employees and employers, and enterprises with foreign participation - residents of the Republic of Kazakhstan on the basis of international treaties (agreements) and the Republic of Kazakhstan legislation.

To ensure the regulation of social and labor relations, collective bargaining and collective preparation of draft contracts, agreements, collective agreements, as well as for arranging monitoring of their implementation by the parties, as a rule, tripartite commissions are formed: the trade unions of employees - state and employers' enterprises.

### 3.2. Medical examinations of the working population

In accordance with the requirements of Art. 278 TC RK employer is obliged to arrange for its own funds mandatory preliminary (at hiring) and periodic (within labor activity) medical examinations (surveys) of employees, extraordinary medical examinations (surveys) of employees on their request in accordance with medical recommendations with maintaining their place of work (position) and average earnings at the time of the passage of these medical examinations, as well as to ensure no permit of employees to perform their work duties without undergoing mandatory medical examinations, as well as in the case of medical contraindications.

The matters of organizing medical examinations for employees are regulated by TC RK: “The employees engaged in arduous jobs or job in harmful and (or) dangerous working conditions (including underground work), as well as job related to the traffic pass, at the expense of the employer, mandatory preliminary (at employment) and periodic (for those aged up to 21 years - annual)

medical examinations (surveys) to determine the suitability of these employees to perform the assigned work and the prevention of occupational diseases. In accordance with medical recommendations listed employees are subject to extraordinary medical examinations (surveys).

Employees of decreed groups: enterprises of the food industry, catering and trade, waterworks, medical and child care, employees of enterprises for sanitation services to the population, as well as some others pass specified medical examinations (surveys) in order to protect community health, prevent the occurrence and spread of diseases (Order of the Ministry of National Economy of 24.02.2015 # 128 "On approval of Rules of compulsory medical examinations: para. 3 "Procedure of mandatory medical examinations of decreed population groups" (Annex # 1)).

Harmful and (or) hazardous production factors and work under which a compulsory preliminary and periodic medical examinations (surveys), and the procedure are determined by laws and regulations approved in the order established by the Government of the Republic of Kazakhstan.

The rules of medical examinations are regulated by the resolution of the Republic of Kazakhstan Government dated September 8, 2006 # 856 "On approval of Rules to ensure the timely passage of preventive, preliminary and obligatory medical examinations of persons subject to such examinations".

According to the Order of the Ministry of National Economy of 24.02.2015 # 128 "On approval of Rules of compulsory medical examinations (Annex # 1 ) all persons engaged in industries associated with exposure to hazardous working conditions, are subject to mandatory pre-admission to work and periodic medical examinations. Order of the Minister of National Economy of the Republic of Kazakhstan dated February 28, 2015 # 175 approved the *List of occupational hazards, occupations in which the mandatory medical examinations are conducted.*

Based on the orders of the Minister of National Economy of the Republic of Kazakhstan "On Approval of the investigation of the Rules of infectious and parasitic, occupational diseases and poisoning of the population" dated June 23, 2015 # 440 (Annex #2), "On approval of the Rules of registration, keeping records of cases of

infectious, parasitic, occupational diseases and poisoning, and the Rules of their reporting" dated June 24, 2015 # 451 (Annex # 3) established:

- The procedure for investigations of cases of occupational diseases and poisoning of the population,
- Terms of registration, keeping records of cases of occupational diseases and poisoning, as well as their reporting,
- Requirements for the preparation of sanitary and epidemiological characteristics of the working conditions of suspected occupational disease and poisoning.

Such regulations that provide for mandatory medical check-ups and examinations are available for all sectors of the economy of Kazakhstan, for which such a need is stipulated, incl.:

➤ □ Order of the Minister of Transport and Communications of the Republic of Kazakhstan dated August 28, 2013 # 666 and Acting Republic of Kazakhstan Minister of Health of September 17, 2013 # 532 *"Rules for medical examination in civil aviation"*;

➤ □ Order of Acting Minister of Health of Kazakhstan dated May 15, 2007 # 307 *"On approval of sanitary and epidemiological rules and norms "Sanitary-epidemiological requirements to the maintenance and operation of control centers and civil aviation air traffic controllers and towerman working conditions"*;

➤ □ order of Acting Minister of Health of the Republic of Kazakhstan dated May 17, 2006 # 220 *"On Approval of the Rules of medical examination of employees directly related to the movement of trains on the railway transport of the Republic of Kazakhstan"*;

➤ □ Order of Republic of Kazakhstan Minister of Health dated April 10, 2007 # 225 " *On approval of sanitary-epidemiological norms "Sanitary-epidemiological requirements to the operation of radio-electronic means and conditions of work with sources of electromagnetic radiation"*;

➤ □ Order of Republic of Kazakhstan Minister of Health of 20 March 2007 # 180 *"On approval of sanitary-epidemiological rules and norms "Sanitary-epidemiological requirements to the maintenance, operation of repair facilities of electric locomotives, diesel locomotives and labor conditions of the employees"*;

➤ □ The order of the Minister of Health of Kazakhstan dated February 11, 2005 # 48 "On approval of the List of professions requiring pre-shift medical examination";

If necessary, by decision of local authorities individual employers may be introduced with additional conditions and indications for mandatory medical examinations (surveys).

Employees engaged in certain activities, including those associated with sources of increased danger (with the influence of harmful substances and unfavorable factors of production), as well as working in high-risk, are subject to mandatory psychiatric examination under the decision of the Government of the Republic of Kazakhstan dated 04.12.2009, # 2015 "On approval of the List of psychiatric medical contraindications for certain types of professional activities, as well as work related to the source of increased danger" (Annex # 5).

*The purpose of the preliminary medical examination when beginning of work:* to determine compliance of health of employees (being examined) with the work being assigned to them.

*Periodic medical examinations (surveys) are carried out in order to:*

1. monitor dynamically employees' health, detect timely early forms of occupational diseases, the early signs of the impact of harmful and (or) hazardous production factors on the health of employees, generate high-risk groups.

2. Identify common diseases being medical contraindications for the continuation of work related to the impact of harmful and (or) hazardous production factors.

3. take timely preventive and rehabilitative measures aimed at maintaining and restoring the health of employees disability.

### **The procedure for conducting medical examinations and linking the disease to the profession**

Preliminary and periodic medical examinations (surveys) are conducted by medical employees of enterprises that have a license for the specified activity.

The employer determines the communities and compiles the list of names of persons subject to periodic medical examinations

(surveys), indicating areas, shops, industries, hazardous work and harmful and (or) hazardous production factors affecting the employees, and after consultation with the Department of Sanitary Inspection Committee, he sends it two months prior the examination to the medical enterprise, which a contract for periodic medical examinations (surveys) was signed with.

Medical enterprise on the basis of the list of names received from the employer of employees subject to periodic examinations (surveys), together with the employer approves schedule of medical examinations (surveys).

The head of the medical enterprise engaged in medical examination, approves the composition of the permanent medical commission, whose chairman shall be a physician-pathologist or a doctor of other specialty having training in Pathology, commission members - experts held in the framework of their specialty training in occupational pathology and having a professional certificate. The Commission shall determine the types and amounts of the necessary studies, taking into account the specificity of the existing production factors and medical contraindications to the implementation or continuation of work on the basis of existing laws and regulations.

Employee to undergo a preliminary medical examination (check-up) is a direction issued to the employer, stating the harmful and (or) hazardous production factors and harmful work, and a passport or other document replacing it, outpatient card or an extract from it with the results of periodic medical examination at the place of previous work, and in the cases stipulated by the legislation of the Republic of Kazakhstan, - the decision of the medical psychiatric commission.

Conclusion permanent medical commission and the results of the medical examination (examination) as preliminary and periodic, as well as an extract from an outpatient employee cards are made to map out preliminary and periodic medical examinations (surveys).

Medical Enterprise in cooperation with the Department of Sanitary Inspection and the employer's representative of the Committee summarizes the results of the preliminary and periodic medical examinations (surveys) of employees and is the final act on its results in four copies. Final Act within 30 days shall be submitted

to the employer by a medical enterprise, the Department of Sanitary Inspection Committee and the center of occupational pathology.

The employee is informed of the results of the medical examination (check-up).

Employees who have undergone preliminary or periodical medical examination, when transferring to another job with the same working conditions and factors of production, the necessary documents are prepared by the attending physician on the basis of the previous extraction data, repeated medical examination is carried out in a timely manner.

In the case of the establishment of signs of occupational disease with the employee, when transferring to other job with a medical examination or during treatment, it is sent to the attending physician, the head of the medical facility or pathologist, in the prescribed manner, to Pathology Center for a special survey in order to clarify the diagnosis and establishment of connection of disease with occupation.

Preliminary and periodic medical examinations of employees working on rotational basis are carried out by medical facilities at the place of permanent medical care or place of dislocation of rotation, subject to the decision of the administration of the rotational enterprises of the issue of funding.

Center for Occupational Pathology in establishing the disease due to the profession makes medical opinion and within three days sends the relevant notification to the Department of Sanitary Inspection Committee, employer, insurer and medical enterprise having sent an employee.

An employee who has a diagnosis of occupational diseases, is sent by occupational pathology center with the relevant conclusion to the medical enterprise in its community, which prepares documents for submission to the medical and social expertise.

Clarification and confirmation of the diagnosis of an infectious or parasitic disease is made by infectious diseases doctor or other specialists in profile of infectious diseases in hospitals.

Linking the infectious or parasitic diseases to professional activities is made in established manner, with the obligatory participation of an infectious disease physician and epidemiologist.

The basic document confirming the professional nature of infectious or parasitic disease infection is a card of the epidemiological survey.

All persons with identified occupational diseases or abnormalities in health that can be attributed to occupational factors must be under medical supervision at the attending physician or medical specialist on the profile of the disease, or at the doctor-pathologist.

**Liabilities and responsibilities of employers,  
Departments of Sanitary Inspection Committee,  
medical enterprises:**

Employer:

- compiles within one month upon receipt from the state bodies of sanitary-epidemiological service of the data on community subject to preliminary and periodic medical examinations, the list of names of persons with an indication of the production, workshops, professions, harmful, hazardous substances and production factors, which exposure employees are exposed to and duration of service under these conditions;
- provides to persons sent for preliminary medical examinations a referral form, wherein the results of medical examinations and the conclusion of the possibility of the assigned work performance for health reasons are recorded;
- when changing the locations of periodic medical examination, before upcoming medical examination, requests personal medical records of their employees and sends them along with a cover letter and list to a health care entity conducting regular medical check-ups;
- ensure timely referral of persons with occupational diseases and suspected ones to a specialized medical enterprise for in-depth examination and treatment;
- develops annually an action plan for improvement of identified patients, agreed with the territorial government body of sanitary-epidemiological service.

Department of Sanitary Inspection Committee:

- before 1 December of the preceding year defines community subject to periodical medical examinations (the workshops, professions, harmful and dangerous production factors);
  - controls the completeness of coverage, quality and timeliness of the preliminary and periodic medical examinations;
  - at the stage of list compile determines the lists of employees who have worked for 10 years or more in harmful working conditions, for the passage of the periodic medical examination;
  - Participates in the compilation of the results of periodic medical examinations of employees;
  - at the request of the medical enterprise presents sanitary-hygienic description of working conditions.

Medical Enterprise:

- upon receipt of coordinated with state bodies sanitary-epidemiological service lists of community subject to medical examinations, creates commission for examination conduct and draws up calendar plan, which defines a list of allocated specialists, the type and scope of laboratory and other examinations specific to existing production factors, time and date of the commission. With the shortage and the lack of medical specialists for conducting inspections, the necessary examinations are carried out in other health entities possessing a license for the specified activity. The plan is coordinated with the administration of the enterprise (employer);
  - the health entity head conducting preliminary and periodic medical examinations approves the composition of the medical committee, the chairman of which must be the doctor-pathologist having retrained for pathology and the specialist certificate (pathologist). Members of the committee are experts that were trained in their specialty in occupational pathology;
  - medical examination is carried out by permanent medical commission, which includes: pathologist, physician, surgeon, neurologist, otolaryngologist, ophthalmologist, dermatologist, gynecologist, radiologist, a doctor of functional diagnostics, physician assistant, dentist. If necessary, the Commission and other involved specialists (cardiologist, allergist, endocrinologist, phthisiologist, hematologist);

- doctors involved in periodic and pre-medical examinations must be familiar with the characteristics of professional activity, and working conditions provided by the employer;
  - Presents quarterly a summary report on the work of the health of the subject for a medical examination in the territorial state bodies of sanitary-epidemiological service;
  - at the end of preventative examination generalizes periodic medical examinations of employees and draws up the final act in 5 copies of the form in accordance with Annex 1 to this Regulation and report form in accordance with Annex 2 to this Regulation, provides to the state bodies of sanitary and epidemiological service, within 30 days after a medical examination. In the annexes to the act is given a list of names of persons who are recommended to transfer to another job, indicated stationary and spa treatment, diet, dynamic monitoring. Upon signature the acts are handed to the administration for the execution, the trade union committee enterprises, state bodies of sanitary-epidemiological service for examination, the territorial health enterprises based on the location of the employer for the job, one copy remains with health entity performed the periodic medical examination.

The rapid development of occupational medicine and its components - ergonomics, engineering psychology, hygiene, work physiology, preventive toxicology evidences the increasing role of the human factor in the production process. Reliability of human job in modern conditions is related to the selection of a professional staff. According to estimates of economists, the introduction of foreign professional selection methods for reducing staff turnover in some industries in 2-2.5 times. It is known that 43% of the injuries in the industry due to mismatch professional employees.

As it is known, the main purpose of professional selection is ensuring maximum compliance with individual characteristics, features and human capacity in order to general and specific requirements that apply to it one or the other type of professional activity. Achievement of this goal allows solution of the task of increasing productivity and saving financial resources, to reduce the number of injuries and accidents at work. Moreover, the rational use of people differing in their psychophysiological capabilities enables a



person to achieve satisfaction with their work and all-round development of the individual.

**Occupational selection** - is a special procedure for studying and probabilistic assessment of the suitability of a person to master the skill, achieve the required level of professional skills and fulfill successfully its professional duties.

The purpose of occupational selection – is identification of the maximum matching of individual characteristics, features and human capacity to general and specific requirements that apply to it by a certain kind of professional activity.

Occupational selection is divided into several types: *social, educational, psychological, psycho-physiological and medical.*

*Social selection* determines the harmonization of the interests of the employer and the employee on the basis of adequately developed legal and ethical framework that helps to regulate the various aspects of occupational selection in modern conditions.

*Educational selection* is designed to detect in a person a body of specific knowledge, abilities and skills necessary for mastering its specialty chosen.

*Psychological professional selection* determines the level of motivation designed to identify in the employee professionally important psychological properties of the person, his moral and ethical qualities that are genetically or socially conditioned.

*Psychophysiological occupational selection* is based on the degree of compliance with the requirements of human psycho-physiological qualities of professional activity. At the same time it analyzes not just the psychological and mental status, and the physiological response of the leading roles of the major body systems (central nervous, autonomic, cardiovascular, respiratory, musculoskeletal, etc.).

*Medical selection* is designed to assess the level of compliance of health and physical development of employee with the features of planned or actual work.

Consequently, occupational selection is a rather multifaceted process, which the participants are not only the employee and the employer, but also the state, social safety funds, health care institutions, each of which produces its own range of interests and a corresponding attitude toward physical fitness problem.

### 3.3. Investigation and registration of accidents at work

Investigation of occupational accidents in some industries and enterprises is performed on the basis of the order of Minister of Labor and Social Protection of Population of the Republic of Kazakhstan dated March 3, 2009 #74-p "On approval of forms of documents related to the accident at work".

**Accident** – is sudden and adverse one-time exposure to the external force on the human body when there is no intent on the part of the victim.

It is taken into account in the legislation on benefits and pensions of social safety. If the injury is related to the implementation of employee job duties and was the fault of the company, the latter is liable.

**Workplace injury** - damage to the health of the employee, resulting in the performance of his job duties, leading to disability.

Depending on the cause of classified and documented as industrial (occupational) injury or other damage to the health of employees received:

- before or after working hours in preparing and putting in order the workplace, the means of production, personal protective equipment, etc.;
- during working hours at the workplace or during travel or elsewhere, finding which was associated with the performance of labor or other duties related to the request of the employer or work organizer;
  - as a result of exposure to hazardous and harmful factors.
  - during working hours, on the way of the employee to the place of work on the instructions of the employer, whose activities are related to the movement of services between the objects;
  - transport to the employer;
  - private transport, with the written consent of the employer for the right to use it for business trips, according to Art. 155 TC RK;
  - during their stay under the orders of an employer in the territory of their own or other enterprises, as well as the protection of property of the employer or performing other actions on its own initiative in the interest of the employer;

▪ at work or during a business trip the employee because of his injuries or deliberate killing of an employee in the performance of labor or official duties.

This list is not final and in each case the connection with the production is determined by the Commission during the investigation.

No injury or other damage to the health of employees at work is reported as industrial (occupational), which is objectively established in the course of the investigation that they occurred:

▪ when the victims performed work, on their own, not related to the employer's interest;

▪ as a result of deliberate (intentional) infliction of harm to health or the commission of a criminal offense by victims (established by a court sentence);

▪ due to the sudden deterioration of the health of a victim is not associated with exposure to hazardous and harmful production factors;

▪ intoxication, consumption of potent toxic and narcotic substances that caused the accident.

For each accident a victim or a witness is obliged to immediately notify the employer or operator.

Responsible officials of healthcare enterprises must inform the employer and the territorial subdivisions of the state labor inspectorate of each case, the primary treatment of injury or other damage to the health of employees at work, as well as cases of acute occupational disease (poisoning) - a government body in the field of sanitary and epidemiological welfare of the population.

Responsibility for the arranging the investigation and registration of industrial accidents is borne by the employer.

The employer (or his representative) must:

- immediately organize the first aid to the victim and, if necessary, deliver it to the medical enterprise;

- take urgent measures to prevent the development of an emergency or other emergency situation, and the impact of traumatic factors in the others;

- maintain environment until the start of an investigation of an accident at work, as it was at the time of the accident, if it does not threaten the lives and health of others and does not lead to disaster,

accident or occurrence of certain extraordinary circumstances, and in failing to maintain it - to fix the current situation (make the charts, take pictures or videotape, perform other activities);

- immediately inform of the accident to bodies and enterprises mentioned in the commented article of Civil Code;

- immediately inform relatives of the victim of serious accidents or accident fatalities;

- take other necessary measures for arrangement and provision of adequate, timely investigation and registration of materials.

All the above actions are performed by any employer, regardless of the place where the accident occurred.

The employer reports of an accident at work or other damage to the health of employees immediately and in writing to,

- territorial units of the authorized state body for labor, as well as the local authorities for emergency situations in case of accidents occurring at hazardous industrial facilities, as defined in Art. 3 of the Law of RK as of April 3, 2002 # 314-II "*On industrial safety at hazardous production facilities*";

- representatives of employees' enterprises (trade unions);

- insurance company subject there is a relevant contract with an insurance company;

- Local State Sanitary and Epidemiological Service bodies of cases of occupational disease or poisoning.

In the event of an accident requiring special investigation, i.e.:

✓  accidents resulting in severe outcome or death;

✓  group accidents occurred simultaneously with two or more employees, regardless of the severity of the injuries suffered;

✓  group cases of acute occupational disease (poisoning), the employer immediately informs:

- law enforcement authority at the place where the accident occurred;

- the competent authorities of the production or departmental control and supervision.

Investigation of the accident is made by a commission created within twenty-four hours, the head of the enterprise since its occurrence, including:

*chairman* - head of the enterprise (production service) or his deputy;

*members* - the head of occupational health service enterprise, a representative body of employees or an authorized proxy of the injured person (subject to approval).

In the case of a professional or an acute occupational disease (poisoning) in the investigation of the commission attended by representatives of authority of State Sanitary and Epidemiological Service or Professional Pathology Center.

A separate investigation of cases of acute occupational disease (poisoning) is made by representatives of authority of State Sanitary and Epidemiological Service or Occupational Pathology Center within twenty-four hours, and of chronic occupational disease - within seven days upon receipt of the message.

Special investigation covers:

- accidents resulting in severe output or death;
- group accidents that occurred simultaneously with two or more employees, regardless of the severity of the injuries suffered;
- group cases of acute occupational disease (poisoning).

The investigation of an accident occurring to an employee directed to another enterprise to perform productive tasks (official or contractual obligations), including persons undergoing practical training, studying in general education, vocational schools and higher education institutions, is conducted by a commission created by the head of the enterprise in whose territory the incident occurred, involving the employer and authorized representative of the victim.

Investigation of the accident, which occurred with the employee enterprise located and conducting work on the territory of the other enterprises, is held by his employer with the participation of the responsible representative of the enterprise on whose territory the accident occurred.

The accident, which occurred with the employee in the performance of part-time work, is investigated and taken into account by the employer in whose territory or on behalf of which the work was done.

Investigation of accidents occurring as a result of accidents of vehicles is carried out on the basis of materials of transport inspectorate investigations.

Transport inspectorate agencies, within five days upon accident, at the request of the chairman of the commission to

investigate the accident, are obliged to provide him with copies of the required documents.

Accidents which were not promptly reported to the employer or operator, or as a result of which the incapacity for work has not occurred at once (regardless of the statute of limitations), are investigated at the request of the victim, his authorized representative or by order of the state labor inspector within ten days upon registration of the application, obtaining a prescription.

When considering traffic accidents it should be borne in mind that the vehicle is a source of danger and it is necessary to distinguish between the responsibility of the employer and the employee in the course of the investigation.

*As a source of the increased danger* must be recognized any activity, the implementation of which creates an increased risk of harm due to the impossibility of full control over it by the person, and the work on the use, transportation, storage of objects, materials and other objects of industrial, commercial and other purposes, having the same properties.

If employee health is damaged in the performance of contractual obligations, labor (service) duties, the duties of military service by a source of danger, the liability for such damage shall be the owner of the source of increased danger.

***Owner of source of increased danger*** - a legal entity or a citizen operating the source of increased danger by virtue of its property rights, the right of economic management, operational management or for other reasons (for lease, power of attorney to manage the vehicle, due to the competent authority orders to transfer increased danger source, etc.).

Based on the collected documents and materials, the Commission sets out the circumstances and causes of an accident, defines the relationship of an accident with the industrial activities of the employer and, accordingly, finds the need for the injured being at the scene by virtue of performance of his job duties, qualifies the accident *as an industrial accident or an unfortunate cases not connected with production*, determines the persons who have violated the health and safety requirements, and measures to eliminate and prevent accidents at work.

Each of accidents caused an employee (employees) disability for more than one day, according to the medical report is registered in an act of the accident in the manner prescribed by order of the Minister of Labour and Social Protection of Population of the Republic of Kazakhstan dated March 3, 2009 # 74-p "*On approval of forms of documents relating to an accident at work*".

The procedure for inspection of the employee to determine the degree of disability resulting from an accident or occupational disease, as well as determination of need for additional forms of assistance and care approved by order of the Minister of Labour and Social Protection of Kazakhstan dated November 7, 2005 # 287-p "*On approval of the Rules of employee evaluation to establish the degree of disability and the need for additional forms of assistance and care as a consequence of injury or other damage to health resulting in the performance of labor (service) duties*".

The basis for the survey is a conclusion of health enterprise issued in accordance with the decision of the Government of the Republic of Kazakhstan dated July 20, 2005 # 750 "*On approval of the Rules of medical and social expertise*", and the act of the accident.

Special accident investigation depending on the severity and consequences shall be held within ten days by the Commission created by the territorial authorized state labor authority, composed of:

*chairman* - state labor inspector;

*members* - the employer, representative or authorized body of employees or trustee of a victim.

Investigation of group accidents, in which two people were killed, is conducted by a commission headed by the chief state inspector of labor of a region, the cities of Astana and Almaty.

When accidents at hazardous industrial facilities, Commission includes the state inspector for prevention and elimination of emergency situations.

When accidents in emergency technogenic situations, chairman of the special investigation committee is appointed by the state inspector for prevention and elimination of emergency situations. In this case, the labor inspector is a member of the state commission.

Investigation of group accidents, which killed three to five people, is conducted by a commission created by the authorized state body for labor, and at the death of more than five people - the Government of the Republic of Kazakhstan.

To solve the issues that require expert advice, chairman of the special investigation establishes an expert sub-committee of the number of enterprises professionals, scientists and regulatory officials.

Further search for victim(s) missing during the explosion, accidents, destruction and other cases at facilities enterprise is determined by the Commission for the special investigation based on the report of the head of rescue units and professional experts, except as required by law.

The examination of witnesses as well as parallel investigations of the accident by someone or other commission in the days of the officially appointed commission is prohibited without the consent of the chairman of the special investigation commission.

Each accident associated with the production, caused the employer (employees) disability for at least one day under the medical report (recommendation) is registered in the forms provided by the Order of the Minister of Labour and Social Protection of the Republic of Kazakhstan dated March 3, 2009 #74- n "*On approval of forms of documents related to the accident at work*".

Occupational diseases and poisoning confirmed in the prescribed manner by the health enterprise are documented regardless of whether or not there is a disability.

An act of industrial accident details circumstances and causes of the accident, specifies the persons who have committed violations of occupational safety requirements, and in determining gross negligence - the degree of fault of the insured.

If during the investigation of an accident at work the Commission establishes that gross negligence was the cause, or increased the damage, the Commission applies a mixed responsibility of the parties and determines the degree of fault of the employee and the employer as a percentage.

At the end of the investigation of each accident, the employer, within three days, is obliged to give the victim or his

authorized representative an act. In addition, one copy of the act is kept by an employer, and the other is sent to state labor inspectors.

In the case of occupational disease and poisoning a copy of the report is also sent to State Sanitary and Epidemiological Service.

In case of disagreement with the result of the investigation or late registration of act the victim, a representative of enterprises employees or other interested person shall have the right to appeal in writing to the employer, who must, within ten days, consider his application and make a decision on the merits.

Disagreements on the investigation and registration of accidents caused in the course of the investigation between the employer, employee and the state labor inspector or the state inspector for prevention and liquidation of emergency situations in cases occurring at hazardous industrial facilities are settled in the subordination of the inspectorate by Chief State labor inspector or chief state inspector for prevention and elimination of emergency situations, or the territorial authority of the Republic of Kazakhstan or in the courts.

The decision of the chief state labor inspector of the Republic of Kazakhstan in the investigation and the classification of accidents both related to production and not associated with it shall be in the form of conclusion.

If state labor inspector opinion differs with the opinion of the majority of members of the commission, he is obliged to sign the act, but with an excuse. He includes his reasoned opinion in the investigation materials.

The state inspector for prevention and liquidation of emergency situations in case of accidents occurring at hazardous industrial facilities, if necessary, his opposition against the reasons contributing to the accident is registered as a technical opinion attached to the materials of a special investigation.

### 3.4. Compulsory social insurance at work

Civil Code of the Republic of Kazakhstan and the Law of the Republic of Kazakhstan # 30-III dated 07.02.2005 "*On compulsory insurance of civil liability of an employer for damage to life and*

*health of employees in the performance of labor (official) duties"* define the legal, economic and organizational basis for compulsory social insurance against industrial accidents and occupational diseases, the procedure for compensation of damage caused to life and health of an employee in the performance of duties under an employment agreement (contract).

Compulsory social insurance against industrial accidents and occupational diseases is a kind of social insurance and provides for:

- social protection of the insured and economic interest of insurance entities to reduce occupational risk;
- compensation for damage caused to life and health of the insured in its performance of duties under the labor agreement (contract) in the other cases established by the Law through providing the insured in full of all the necessary forms of security for insurance, including the payment for medical expenses, social and professional rehabilitation;
- provision of preventive measures to reduce occupational accidents and diseases.

**Subject of compulsory social insurance** against industrial accidents and occupational diseases – is the property interests of individuals associated with the loss by these physical persons of health, occupational disability or death as a result of an industrial accident or occupational disease.

**Insurance entities** – are the insurant, the insured, the insurer.

**Insurant** – is a legal entity of any organizational-legal form of an individual who employs persons subject to compulsory social insurance against industrial accidents and occupational diseases.

**Insured** - 1) an individual subject to compulsory social insurance against industrial accidents and occupational diseases;

2) an individual who has received the health damage caused by an accident at work or occupational disease, confirmed in the established manner and resulting in loss of employability.

**Insurer** - a person making insurance, that is a person bound in occurrence of the insured event to make insurance payment to the insurant or other person in whose favor the contract (beneficiary) was concluded, within a certain contract amount (sum insured).

**Insured event** – duly confirmed fact of damage to the health of the insured due to an accident at work or occupational disease, the occurrence of which involves the obligation of the insurer to carry on insurance benefits.

**Insurance premium** - a compulsory payment on compulsory social insurance against industrial accidents and occupational diseases, calculated on the basis of insurance rate, discounts (premiums) to the insurance rate that the insurant is obliged to pay to the insurer.

**Insurance rate** - the insurance premium rate is charged with working on all grounds (income) pay the insured.

**Providing insurance** - the insurance compensation for damage caused as a result of an insured event of the insured life and health, in the form of sums of money paid or compensated by the insurer to the insured or to persons eligible under this legislation.

**Occupational risk** - the probability of damage (loss) to the insured's health or death associated with the performance of his duties under the labor agreement (contract) and in other cases established by this legislation of RK.

**Occupational capacity** - a person's ability to perform work of a particular qualification, volume and quality.

**Insurance** - is the generation of special funds (hedge funds) at the expense of enterprises and citizens, designated for the compensation of damage, losses caused by adverse events, accidents. From the insurance funds the victims are paid the insured sum of a certain amount. The principal point in the current legislation of the Republic of Kazakhstan is the standard that insurance against accidents at work and occupational diseases is compulsory. All enterprises, regardless of ownership, are obliged to insure their employees.

The main principles of compulsory social insurance against industrial accidents and occupational diseases are as follows:

- warranty rights of the insured for insurance benefits;
- economic interest of the subjects of insurance in improving conditions and increasing safety, reducing workplace injuries and occupational diseases;

- mandatory registration as insurers of all persons employing (attracting to labor) employees subject to compulsory social insurance against industrial accidents and occupational diseases;
- obligatory payment by insurers of insurance premiums;
- differentiation of insurance rates depending on the class of occupational risk.

Compulsory social insurance against industrial accidents and occupational diseases applies to:

- individuals performing work under an employment agreement (contract) concluded with the insurer;
- individuals sentenced to imprisonment and attracted to work by the insurer.

Individuals performing work on the basis of a civil contract shall be subject to compulsory social insurance against industrial accidents and occupational diseases, if in accordance with this contract the insurer is obliged to pay premiums to the insurant.

Law of RK "On mandatory insurance of civil liability of vehicle owners" dated 1 July 2003 # 446-II and the Law "On obligatory insurance of civil liability of carrier to passengers" dated July 1, 2003 # 444-II regulate relations arising in the field of compulsory insurance of civil liability of owners of vehicles, and carriers to passengers and establish the legal, financial and organizational basis of its conduct.

In accordance with the Law of RK "On mandatory insurance of civil liability of the employer for damage to life and health of employees in the performance of labor (official) duties" the Resolution of RK Government dated 30 June 2005 # 652 approved the Rules of classification of economic activities in occupational risk classes, which define the procedure of the ratio of economic activity to the class of occupational risk, the relevant level of industrial accidents and occupational diseases which have developed for this type of activity (Annex # 5).

Economic activities are differentiated into groups depending on the class of occupational risk.

The assignment of economic activities to the occupational hazard classes in accordance with Annex to this Regulation provides for 22 occupational risk classes.

The class of occupational risk by type of economic activity is defined by value of the average occupational risk.

Average occupational risk index for each type of economic activity is calculated as the arithmetic average of the amount of occupational risk indicators for a particular type of economic activity for the previous five years.

These rules determine the procedure for classification of economic activities in the class of occupational risk so as to establish insurance rates for compulsory social insurance against industrial accidents and occupational diseases.

Occupational risk class is determined based on the value of the integral index of occupational exposure, taking into account the level of industrial injuries, occupational diseases and the costs of providing insurance, formed by economic activities of insurers.

An integral component of occupational risk by kind of economic activity is determined by the formula:

$$In = \frac{E_{\text{вв}}}{E_{\text{фom}}} \times 100\%,$$

where:

*In* – an integral index of occupational risk for this type of economic activity, expressed as a percentage;

*E<sub>вв</sub>* - the total cost of insurance benefits for this type of economic activity during the previous calendar year;

*E<sub>фom</sub>* - the amount of the wage fund for this kind of economic activity, to which the insurance contributions for compulsory social insurance against industrial accidents and occupational diseases in the past calendar year were accrued.

Assessment of occupational risk a certain kind of economic activity is based on the following statistical index of accidents at work and occupational diseases:

- the number of victims in accidents related to work annually;
- the annual gross amount of payments to victims of work-related accidents, including the average amount of accrued benefits for each victim of the accident;
- the number of victims of occupational disease per year;

- the annual amount of accrued payments to victims of occupational disease, including the average amount of accrued benefits for each victim of the occupational disease;
- the number of those killed in work-related accidents;
- the annual amount of accrued benefits in the event of the work-related death of employees, including the average amount of the accrued benefits;
- annual wage fund by kind of economic activity;

Each of the statistics listed above is formed in the dynamics of the previous five years.

In the case where the insurer is engaged in several economic activities, he is subject to occupational risk class corresponding to main type of his activity.

In the case where the insurer carries out several kinds of economic activity uniformly distributed in the total volume of production, he is subject to the kind of economic activity, which corresponds to a higher class of occupational risk.

According to the Law of RK of 2013 "On pension provision in the Republic of Kazakhstan" in the pension system a new type of compulsory pension contributions – occupational one occurred. Compulsory occupational pension contributions (COPC) are transferred by employers for the benefit of their employees; COPC amount is set to within 5% of the monthly income of the employee. List of industries, jobs, professions of employees employed in jobs with harmful (especially harmful) working conditions, which are carried out in favor of compulsory occupational pension contributions is approved by Decree of the Government of the RK dated 31.12.2013 #1562. These occupational contributions are provided for to employees subject to harmful factors (if there are at least 80% of employment in jobs with harmful (extra harmful) working conditions, as well as in maintaining hazardous working conditions (not less than hazard class 3) related to the specifics of production and the result of the qualification of production facilities).

The amount of compensation for the harm caused to employee depends primarily on the degree of occupational ability which definition in the percentage is assigned to the medical and social expert (ITU) commission of RK entities (Government

Resolution dated July 20, 2005 #750 "On approval of the Rules for medical and social expertise").

These Rules of Medical and Social Expertise approved by Resolution of the Government were developed in accordance with the laws of the Republic of Kazakhstan "On social protection of disabled persons in the Republic of Kazakhstan", "On Compulsory Social Insurance", "On compulsory insurance of civil liability of the employer for damage to life and health of an employee in the performance of labor (official) duties" and regulate the procedure for the establishment of disability and the degree of disability, and the determination of need for additional forms of assistance and care.

The establishment of disability and the degree of disability, the identification of needs for additional forms of assistance and care is carried out by means of medical and social expertise (MSE) by territorial subdivisions of the central executive body in the field of social protection (territorial units).

Objectives of medical and social expertise:

1. the establishment of disability and degree of disability with defining the cause, time, occurrence time and the need for additional forms of assistance and care;

2. development of individual rehabilitation programs for the disabled, assistance in the implementation of rehabilitation measures to enterprises engaged in social services, medical and social rehabilitation and monitoring their effective implementation of these activities.

Functions of medical and social expertise :

1. the establishment of disability and degree of disability with the determination of causes, time, time of occurrence and need for additional forms of assistance and care;

2. definition of needs of individuals in the sanatorium-resort care, supplementary feeding, care, including the purchase of special medical drugs, health products, technical auxiliary (compensatory) means and (or) special means of transport and other forms of assistance;

3. the establishment of a causal link of the death of a disabled person in cases where the legislation of the Republic of Kazakhstan provides for the provision of social benefits to the family of the deceased;

4. development and correction of the disabled individual rehabilitation program, definition of type, form, timing and extent of measures for medical, social and vocational rehabilitation, periodic inspection, the dynamic monitoring the implementation of rehabilitation measures, determining the effectiveness of these measures;

5. extension of temporary disability for a period of rehabilitation treatment;

6. representation in the military commissariat of information on all cases of recognition of disabled persons and draft age personnel;

7. consulting assistance to physicians of medical institutions for medical and social expertise and rehabilitation of the disabled, participation in activities to improve their skills;

8. Introduction in practice of modern scientific principles and methods, as well as a generalization, dissemination of best practices and development of guidelines for medical and social expertise and rehabilitation of disabled persons.

**Disability** - the degree of restriction of human life due to health problems with the persistent disorder of body functions.

**Medical and social expertise** – duly determination of the needs of an individual under expertise for the social protection measures, including rehabilitation, based on an assessment of life restrictions caused by the persistent disorder of body functions.

**Survey** - carrying out medical and social expertise, the aim of which is to assess the ability to live limitations, changes in the health status with a disorder of body functions, with the definition of clinical, functional and labor prognosis, rehabilitation and social protection measures.

**Physical dysfunction** - a complete or partial loss of a person's ability or capacity to carry out self-service, self-moving, navigate, communicate, control own behavior, learn and engage in employment.

These rules establish the procedure for referral to medical and social expertise and survey. They also show the criteria for determination of disability groups establishing the degree of loss of general capacity for work, as well as criteria for the degree of loss of employee disability, injured or other damage to health associated



#### Charter 4 CERTAIN ISSUES OF MEDICAL ECOLOGY

with the execution of labor (service) duties. The annexes to the Rules of Medical and Social Expertise established a classification of violations of the fundamental functions of the body and disability; list of anatomical defects, in which the degree of disability is established for an indefinite period of re-survey; list of medical indications for provision to the disabled with means of transport.

In accordance with the Law of 13 July 1999 "*On state social assistance to persons worked in underground and open cast mining in jobs with extra harmful and hard working conditions*" the RK Government Resolution dated 25 December 2007 # 1283 made additions and changes in the Government Resolution of 19 December 1990 # 1930, which approved:

1) List #1 of productions, works, professions, positions and indicators in underground and open cast mining in jobs with especially harmful and hazardous working conditions;

2) List #2 of productions, works, professions, positions and indicators in the work in harmful and hazardous working conditions.

Order of MLSP of Kazakhstan dated August 28, 2008 # 226-p made additions and changes in the order of MLSP of Kazakhstan of July 31, 2007 # 182-p "*On approving the List of production facilities, workshops, professions and positions, list of heavy work, work under harmful (extra harmful) and (or) dangerous working conditions, work in which entitles to reduced working hours and additional paid annual labor holiday and Instructions on its use*".

Resolution of RK Government dated 27 April 2007 # 336 approved the *Rules of lump compensation of injury (trauma. Wounds, contusion, occupational disease) or fate (death) of a judge due to the performance of official duties*.

The recent decades have been witnessing an ever-increasing interest towards various aspects of the environmental protection problem as a result of exhaustion, pollution and degradation. The key reason for the emergency reality of this problem is an intensive change of the environment under the impact of man-made activity: rapid development of industry, power economy and transport, chemicalization of agriculture and living conditions, urbanization, growth of cities, what altogether leads to the increase of industrial, agricultural, transport, household and other wastes heavily polluting the environment. These can have both direct and indirect impact on health and morbidity of population, on their conditions of labor, living and recreation [28-31].

The negative trends of change of the environment quality – ambient air, water and soil – cause anxiety and concern not only among experts in the field of environment, occupational medicine, hygienists and other experts, but also among the public and governments of multiple countries. Environment protection issues form one of the most important contemporary problems, which have multiple aspects of economic, politic, law, legal and environmental nature. The principal value is attributed to its medical and environmental aspects, since it is exactly them that determine the necessity and scope of expensive measures on environmental protection to the benefit of preservation and promotion of population health.

**Medical ecology** is one of medical science sections developing medical aspects of the environmental protection as a scientific basis for prevention of negative impacts of environmental factors on population. Medical ecology is a complex, integrating section of medical science, which comprehensively studies common consistent patterns of interaction of human organism with environmental factors of various nature, adaptive and accommodational processes, mechanisms of interactions of organism, at all levels of its structural and functional organization, with a complex of negative chemical, physical, biological factors of the

environment of man-made and natural origin, as well as with a complex of social induced factors.

Goal of medical ecology – scientific justification of common principles and approaches to sanitation of the conditions of living, labor, household and recreation, to protection and promotion of population health in permanently changing environmental conditions.

Objectives:

- identification of high-priority surrounding and working environment harmful factors having a longtime impact on organism and establishment of their safe levels and exposures, degree of risk to health;
- development of medical and hygienic criteria of environmental monitoring and zoning of an industrial region and (or) territorial production complex;
- analysis of emergence of deconditioning processes in organism at the stage of forming of pre-pathological changes, with relevant development of diagnostic measures, as well as of methods to recover adaptive capabilities of organism and increase its responsiveness and resistivity;
- study of the epidemiology of public and occupational morbidity, correlation of demographic parameters, as well as of overall indicators of health status of various population groups with the environmental situation;
- ecotoxicological assessment of harmful factors of the environment and study of mechanisms of isolated, combined and complex impacts of chemical, physical and biological factors on living organism;
- development of scientific fundamentals of forecasting public and professional morbidity depending on the eco-production situation of a region.

It should be noted that the process of development of medical ecology as a science is intensively ongoing, since it is an important issue, and its relevance grows proportionally to economic development of any country. Contemporary problems of globalization, as a leading trend of the world economy development, not only implicate a heavy technological growth, expansion of international integration and competition, formation of transregional

integration associations, but also originate new environmental problems. Specificity of present-day human activity assumes the scales of global processes leading to the change of natural biogeochemical cycles on the Earth, to the disturbance of the ecological equilibrium, which, in their turn, affect humans themselves. Today, the environmental protection is becoming one of the most important problems, since the health of current and future generations will depend on its solution.

**National and international legislation in the field of ecology**

The years of independence in Kazakhstan were to become the years of formation and establishment of a completely new state system for ensuring environmental safety, management of environmental protection and use of natural resources – a well-organized and territorially-branched system of environmental protection executive bodies of the Republic of Kazakhstan. This allowed to ensure the formation and sequential implementation of the state policy in the field of environmental protection and rational use of natural resources.

The basis of the law making process in the field of environmental protection and management is a number of international conventions and agreements of universal, regional and local nature on the issues of environmental protection. These documents found their way into the internal national legislative acts of RK, such as the Concept of Environmental Safety of RK for 2004-2005 approved by Decree No.1241 of President of the Republic of Kazakhstan dated 3 December 2003, Laws “On environmental protection”, “On specially protected natural reservations”, “On protection of ambient air”, Decrees of the President having the power of Law; “On subsurface and subsurface use”, “On oil”, Ecological, Forest, Water and Land codes. The majority of necessary sublegislative regulatory legal acts has also been developed and approved (Table No.5).

**Table No. 5.** Legislative and other regulatory legal acts in the field of environmental protection (as of 01.01.2015).

<b>No. in sequence</b>	<b>Status and number of document, date of approval</b>	<b>Document name (full)</b>
<b>1</b>	<b>2</b>	<b>3</b>
1.	Code of RK No. 212-3 dated 09.01.2007	Environmental code of the Republic of Kazakhstan
2.	Code of RK No. 481-2 dated 09.07.2003	Water code of the Republic of Kazakhstan
3.	Code of RK No. 477-2 dated 08.07.2003	Forest code of the Republic of Kazakhstan
4.	Law of RK No. 175-3 dated 07.07.2006	On protected areas
5.	Law of RK No. 93-III dated 13.12.2005	On compulsory ecological insurance
6.	Law of RK No. 593-2 dated 09.07.2004	On protection, reproduction and use of animal world
7.	Law of RK No. 331-2 dated 03.07.2002	On plant protection
8.	Law of RK No. 344-1 dated 11.02.1999	On quarantine of plants
9.	Law of RK No. 93-1 dated 14.04.1997	On use of nuclear energy
10.	Law of RK No. 2828 dated 27.01.1996	On the subsurface and its utilization
11.	Law of RK No. 2350 dated 28.06.1995	On oil
12.	Decree of Government of RK No.88 dated 08.02.2011	On approval of the Rules for introduction of the state cadaster on disposal of harmful substances, radioactive waste and discharge of waste water to subsurface
13.	Decree of Government of RK No.2125 dated 15.12.2009	On approval of the Rules for concession of waterbodies to separate or joint use through tender

<b>1</b>	<b>2</b>	<b>3</b>
14.	Decree of Government of RK No.832 dated 05.06.2009	On approval of the Rules for use of water supply and water discharge systems of residential areas
15.	Decree of Government of RK No.788 dated 28.05.2009	On approval of the Rules for collection of waste water to water discharge systems of residential areas
16.	Decree of Government of RK No.690 dated 12.05.2009	On approval of the Rules for ensuring safety of water utilization systems and structures
17.	Decree of Government of RK No.128 dated 11.02.2008	On approval of the Rules for limitation, suspension or reduction of emissions of greenhouse gases to the atmosphere
18.	Decree of Government of RK No.124 dated 08.02.2008	On approval of the Rules for state record-keeping of sources of greenhouse gas emissions to the atmosphere and consumption of ozone-destroying substances
19.	Decree of Government of RK No.107 dated 06.02.2008	On approval of the Rules for trading quotes and obligations for reduction of emissions to the environment
20.	Decree of Government of RK No.1372 dated 29.12.2007	On approval of the technical regulation on requirements to emissions of harmful (polluting) agents of motor vehicles commissioned on the territory of the Republic of Kazakhstan
21.	Decree of Government of RK No.638 dated 27.07.2007	On approval of the Rules for open tendering of projects in the field of environmental protection
22.	Decree of Government of RK No.557 dated 30.06.2007	On approval of the List of polluting agents and types of waste to be assigned emission limits and charged for emissions to the environment
23.	Decree of Government of RK No.457 dated 05.06.2007	On approval of the Rules for licensing and qualification requirements set out to the activity on implementation of works and provision of services in the field of environmental protection

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24.	Decree of Government of RK No.486 dated 31.05.2006	On approval of the Rules of establishment of economic assessment of damage caused by environmental pollution
25.	Order of the Ministry of Environment Protection 204-п dated 28.06.2007	On approval of the Instruction on assessment of the impact of planned or another activity on the environment while developing pre-plan, plan, pre-design and desing documentation
26.	Order of the Ministry of Environment Protection No. 207-п dated 28.06.2007	On approval of the Rules for execution of state ecological expertise
27.	Rules No. 50-п dated 11.03.2001, Ministry of Natural Resources	Rules for organization of production control in the field of environmental protection
28.	Order of acting Minister of Environment Protection of the Republic of Kazakhstan No.158-п dated 21.05.2007	On approval of the Methodology for determination of emission limits to the environment
<i>Laws of the Republic of Kazakhstan</i>		
29.	No. 259 dated 07.06.2007	Law of the Republic of Kazakhstan “On ratification of Stockholm Convention on persistent organic pollutants”
30.	No. 239 dated 20.03.2007	Law of the Republic of Kazakhstan “On ratification of Rotterdam Convention on procedure on the prior informed consent concerning dangerous chemical substances and pesticides in international trade”
31.	No. 212 dated 09.01.2007	Environmental code of the Republic of Kazakhstan
32.	No. 213 dated 09.01.2007	Law of the Republic of Kazakhstan “On introduction of amendments and additions to some legislative acts of the Republic of Kazakhstan on environmental issues”

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33.	Decree of President of RK No. 216 dated 14.11.2006	Concept of transition of the Republic of Kazakhstan to sustainable development for 2007-2024
34.	Decree of President of RK No. 1241 dated 03.12.2003	Concept of environmental safety of the Republic of Kazakhstan for 2004-2015
<i>Technical regulation</i>		
35.	Decree of Government of the Republic of Kazakhstan No. 46 dated 26.01.2009	On approval of Technical Regulation “Requirements to emissions to the environment while producing ferroalloys”
36.	Decree of Government of the Republic of Kazakhstan No.1232 dated 14.12.2007	On approval of Technical Regulation “Requirements to emissions to the environment while burning various types of fuel in boilers of thermal stations”
37.	Decree of Government of the Republic of Kazakhstan No. 1207 dated 06.08.2009	On approval of Technical Regulation “Requirements to emissions to the environment while producing alumina via Bayer agglomeration method”
<i>Other regulatory legal acts</i>		
38.	Decree of Government of RK No.848 dated 27.09.2007	Target indicators of transition to sustainable development
39.	Decree of Government of RK No.638 dated 27.07.2007	Rules for open tendering of projects in the field of environmental protection
40.	Decree of Government of RK No.566 dated 03.07.2007	Rules for keeping of state register of contaminated areas
41.	Decree of Government of RK No.521 dated 21.06.2007	List of protected natural environment locations of special environmental, scientific and cultural value
42.	Decree of Government of RK No.448 dated 01.06.2007	Rules for determination of target indicators of environment quality

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43.	Decree of Government of RK No.270 dated 04.04.2007	Criteria and characteristics for determination of unfavorable natural phenomena
44.	Instruction of Prime Minister of the Republic of Kazakhstan No.108-p dated 28.04.2007	Measures on execution of Environmental Code of the Republic of Kazakhstan and Law of the Republic of Kazakhstan "On introduction of amendments and additions to some legislative acts of the Republic of Kazakhstan on environmental issues"
45.	Environmental protective measures plan No. 172 dated 31.05.2007 coordinated with Ministry of Emergency Situations, Ministry of Health, Agency for land resources management, Ministry of Energy and Mineral Resources, Ministry of Education and Science	List, form and terms of information exchange for keeping the Single state system of monitoring the environment and natural resources
46.	No. 324-п dated 27.10.2006	List of current regulatory legal acts of Ministry of Environmental Protection in the field of environmental protection
<i>Protection of ambient air</i>		
47.	Order of Ministry of Environmental Protection No.61-II dated 24.02.2004	Instruction on coordination and approval of design standards of maximum permissible emissions (MPE) and maximum permissible discharges (MPD).
48.	Order of Ministry of Environmental Protection No. 217-п dated 04.08.2005	Rules for inventory of emissions of harmful (polluting) agents, harmful physical impacts on ambient air and their sources

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49.	Orders of Minister of Ecology and Bio-resources of RK dated 01.08.1997 and Ministry of Natural Resources and Environmental Protection of RK No. 156 dated 06.07.2000 included in the List of current regulatory legal acts in the field of environmental protection, Order of Ministry of Environmental Protection No. 324-п dated 27.10.2006	Recommendations on execution and content of draft standards of maximum permissible emissions to the atmosphere (MPE) for enterprises of the Republic of Kazakhstan RND 211.02.02-97.
50.	Order of Ministry of Natural Resources and Environmental Protection of RK No. 516-II dated 21.12.00 Included in the List of current regulatory legal acts in the field of environmental protection, Order of Ministry of Environmental Protection No. 324-п dated 27.10.2006	Instruction on standardization of emissions of polluting agents to the atmosphere
51.	Order of Ministry of Environmental Protection of RK No. № 226-п dated 01.10.2004 Included in the List of current regulatory legal acts in the field of environmental protection, Order of Ministry of Environmental Protection No. № 324-п dated 27.10.2006	Branch industry on standardization of harmful emissions to the atmosphere for thermal electric power stations and boiler stations. RND 34.02.303.90

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52.	Order of Ministry of Environmental Protection of RK No. 266-п dated 01.10.2004 Included in the List of current regulatory legal acts in the field of environmental protection, Order of Ministry of Environmental Protection No. № 324-п dated 27.10.2006	Instructions and standards of technological design and technical and economic indicators of energy economy of ferrous industry enterprises. Ferroalloy plants. Volume 20. Protection of atmosphere. ANTP 10-8-80. Ministry of Iron and Steel Industry of USSR, 1981 Document in printed version (difficult to read)
53.	Order of Ministry of Environmental Protection No. 348-п dated 13.12.2007 (according to clause 30 of article 17 of Ecological Code of the Republic of Kazakhstan)	Rules for inventory of greenhouse gases and ozone-destroying agents
54.	Order of Ministry of Environmental Protection No. 350-п dated 13.12.2007 (according to clause 30 of article 17 of Ecological Code of the Republic of Kazakhstan)	Rules for development and approval of standards of maximum permissible emissions and greenhouse gases and consumption of ozone-destroying agents
55.	Decree of Government of RK No.128 dated 11.02.2008	Rules for limitation, suspension or reduction of emissions of greenhouse gases to the atmosphere
56.	Decree of Government of RK No.124 dated 08.02.2008	Rules for state record-keeping of sources of greenhouse gas emissions to the atmosphere and consumption of ozone-destroying agents
57.	Decree of Government of RK No.1232 dated 14.12.2007	Technical Regulation "Requirements to emissions to the environment while burning various types of fuel in boilers of thermal power stations"

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<i>Protection of water resources</i>		
58.	Order of Minister of Agriculture of RK No. 19-1/441 dated 15.05.2015	On approval of Rules for development and approval of standards of maximum permissible adverse effects on waterbodies
59.	Order of Minister of Environmental Protection of RK 40-e dated 24.02.2012	On approval of Rules for handling persistent organic pollutants and waste containing them.
60.	Order of Ministry of Ecology and Bio-resources of RK dated 1992 Included in the List of current regulatory legal acts in the field of environmental protection, Order of Ministry of Environmental Protection No. № 324-п dated 27.10.2006	Recommendations on execution and content of draft standards of MPDs to waterbodies for enterprises.
61.	Order of Ministry of Natural Resources and Environmental Protection No. 516-п dated 21.12.00 Included in the List of current regulatory legal acts in the field of environmental protection, Order of Ministry of Environmental Protection No. № 324-п dated 27.10.2006	Instruction on rationing of discharges of pollutants to waterbodies of RK. RND 211.2.03.01-97
62.	Order of Ministry of Ecology and Bio-resources of RK dated 21.05.94 Included in the List of current regulatory legal acts in the field of environmental protection, Order of Ministry of Environmental Protection	Recommendations on carrying out control over the operation of treatment facilities and discharge of waste water.

	No. № 324-п dated 27.10.2006	
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63.	Order of Ministry of Ecology and Bio-resources of RK dated 27.06.94 Included in the List of current regulatory legal acts in the field of environmental protection, Order of Ministry of Environmental Protection No. № 324-п dated 27.10.2006	Rules for protection of surface waters of RK RND 01.01.03-94
<i>Production and consumer waste</i>		
64.	Order of Ministry of Ecology and Bio-resources of RK dated 17.12.93 Included in the List of current regulatory legal acts in the field of environmental protection, Order of Ministry of Environmental Protection No. № 324-п dated 27.10.2006	Regulatory documents. Production and consumer waste. System of regulatory requirements. RND 03.0.0.0.01-93.
65.	Order of Ministry of Environmental Protection of RK No. 331-п dated 08.12.2005 Included in the List of current regulatory legal acts in the field of environmental protection, Order of Ministry of Environmental Protection No. № 324-п dated 27.10.2006	Rules for assigning hazardous wastes, generated in the process of activity of individuals and entities, to a certain class of hazard.

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66.	Order of Ministry of Environmental Protection of RK No. 164-п dated 24.05.05 Included in the List of current regulatory legal acts in the field of environmental protection, Order of Ministry of Environmental Protection No. № 324-п dated 27.10.2006	Rules for development by individuals and legal entities of waste handling draft standards with their submission for approval to an authorized body in the field of environmental protection of the Republic of Kazakhstan (Ceased to be in force)
67.	Order of Ministry of Ecology and Bio-resources of RK dated 29.08.97	Procedure for setting limits on production waste generation and disposal. RND 03.1.0.3.01-96.
68.	Decree of Government of RK No.591 dated 10.07.2007	Rules for generation of liquidation funds of waste landfill deposits
69.	Decree of Government of RK No.594 dated 11.07.2007	Rules of import, export and transit
70.	Decree of Government of RK No.919 dated 08.10.2007	Rules of management of unowned hazardous wastes recognized by court judgement as passed into ownership of the Republic
71.	Order of Ministry of Environmental Protection of RK No.128-п dated 30.04.2007	Form of hazardous waste data sheet
72.	Order of Ministry of Environmental Protection of RK No.316-п dated 02.11.2007	Form of report on hazardous wastes
73.	No.349-п dated 13.12.2007 (letter to MOJ dated 21.12.07, No. 04-2-1-3/2684-п).	On introduction of amendments to Order of the Minister of Environmental Protection of the Republic of Kazakhstan No. 316-п dated 02.11.2007 "On approval of the report on hazardous wastes"

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74.	Order of acting Minister of Environmental Protection of RK No. 244-п dated 02.08.2007	List of wastes to be placed at landfill deposits of various classes
75.	Order of Ministry of Environmental Protection of RK No. 169-п dated 31.05.2007	Classifier of wastes
76.	Order of Ministry of Environmental Protection No. 188-п dated 07.08.2008	On introduction of amendments and additions to Order of the Minister of Environmental Protection of the Republic of Kazakhstan No. 169-п dated 31.05.2007 "On approval of the Classifier of wastes"
77.	Order of Ministry of Environmental Protection of RK No. 237 dated 25.07.2007 (according to clause 18 of article 17 of Ecological Code of RK).	Instruction on keeping the State cadaster of landfills of hazardous substances, radioactive wastes and discharge of waste water to subsurface
78.	Decree of Government of RK No. 140 dated 15.02.2008	On approval of the Rules of utilization and disposal of food products posing a threat to life and health of humans and animals and to the environment
<i>State control in the field of environmental protection</i>		
79.	Order of Minister of Ecology and Bio-resources of RK dated 01.08.1995 Included in the List of current regulatory legal acts in the field of environmental protection, Order of Ministry of Environmental Protection No. № 324-п dated 27.10.2006	Instruction on organization of state ecological control over application, storage, transportation and detoxication of pesticides and mineral fertilizers. RND 03.7.66.01-95

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80.	Order of Ministry of Environmental Protection of RK No. 144-п dated 24.06.2003 Included in the List of current regulatory legal acts in the field of environmental protection, Order of Ministry of Environmental Protection No. № 324-п dated 27.10.2006	Instruction on execution of state control over environmental protection by officials of the Central Executive Body of the Republic of Kazakhstan in the field of environmental protection.
81.	Approved by Vice-Minister of Ecology and Bio-resources of the Republic of Kazakhstan as of 02.07.97 Included in the List of current regulatory legal acts in the field of environmental protection, Order of Ministry of Environmental Protection No. № 324-п dated 27.10.2006	Instruction on control over the technical conditions of waste (product) pond hydraulic structures of industrial enterprises of the Republic of Kazakhstan. RND 03.7.06.5-96
82.	Order of Ministry of Environmental Protection of the Republic of Kazakhstan No. 129-п dated 14.04.2005 (with amendment as of 27.05.05 No.167-п)	Instruction on control over the operation of treatment facilities and waste water disposal.
83.	Approved by the Ministry of Ecology and Bio-resources of RK in 1997.	Temporary instruction on implementation of state control over protection of the environment against pollution by anisometric dimethylhydrazine



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84.	Annex No.3 to Order of Ministry of Natural Resources and Environmental Protection of RK No. 208-п dated 20.07.02	Guidance on application of sanctions restricting natural resource users' economic and other activities carried out with violation of the legislation in field of environmental protection, environmental requirements and standards of its quality
85.	Order of Ministry of Environmental Protection of RK No. 100-п dated 05.04.2007	Forms of documents concerning organization and execution of state ecological control
86.	Order of Ministry of Environmental Protection of RK No. 123-п dated 24.04.2007	Rules for coordination of production ecological control programs and requirements to reports on results of production ecological control
87.	Order of Ministry of Natural Resources and Environmental Protection of RK No. 50-п dated 11.03.2001 Included in the List of current regulatory legal acts in the field of environmental protection, Order of Ministry of Environmental Protection No. № 324-п dated 27.10.2006	Rules for organization of production control in the field of environmental protection
<i>Laboratory and analytical control in the field of environmental protection</i>		
88.	Order of Ministry of Environmental Protection of RK No.65 dated 22.02.2006	Instruction on sampling while controlling soil contamination by oil and oil-products. Main requirements.
<i>Economics of natural use</i>		
89.	Decree of Government of RK No.107 dated 06.02.2008	Rules for trading quotes and obligations for reduction of emissions to the environment

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90.	Decree of Government of RK No.65 dated 25.01.2008	On introduction of amendment to Decree of the Government of the Republic of Kazakhstan No. 1314 dated 28.12.2007
91.	Decree of Government of RK No.1314 dated 28.12.2007	Basic and marginal rate of payment for emissions to the environment and additions to them
92.	Decree of Government of RK No.653 dated 31.07.2007	Criteria for assessment of ecological situation of territories
93.	Decree of Government of RK No 581 dated 07.07.2007	Ecological criteria for land assessment
94.	Decree of Government of RK No 557 dated 30.06.2007	List of pollutants and types of wastes subject to be standardized and charged for emissions to the environment
95.	Decree of Government of RK No 535 dated 27.06.2007	Rules for economic assessment of damage from the environment pollution
96.	Approved by Order of acting Minister of Natural Resources and Environmental Protection No. 516-п dated 21.12.2000	Instruction on determination of payments for thermal pollution of surface waters

1	2	3
<i>Ecological examination and standardization</i>		
97.	Joint Order of Ministry of Natural Resources and Environmental Protection of RK No. 182-11 dated 09.07.99, and of Ministry of Energy, Industry and Trade of the Republic of Kazakhstan. Included in the List of current regulatory legal acts in the field of environmental protection, Order of Ministry of Environmental Protection No. № 324-п dated 27.10.2006	Instruction on observance of ecological safety standards while designing and carrying out oil operations in water areas and near-shore zones of seas and in inland water bodies of the Republic of Kazakhstan.
98.	Order of Ministry of Environmental Protection of RK No.114-п dated 17.04.2007	Form of report on state ecological examination
99.	Order of Ministry of Environmental Protection of RK No.204-п dated 28.06.2007	Instruction on assessment of the impact of planned or another activity on the environment while developing pre-plan, plan, pre-design and desing documentation
100.	Order of Ministry of Environmental Protection of RK No.62-п dated 20.03.2008	On introduction of amendment to the Order of the Minister of Environmental Protection of the Republic of Kazakhstan “On approval of the Instruction on assessment of the impact of planned or another activity on the environment while developing pre-plan, plan, pre-design and desing documentation”

1	2	3
101.	ПМООС РК № 296-п от 09.10.2007 г.	On introduction of amendments to Order of the Minister of Environmental Protection of the Republic of Kazakhstan No. 207-п dated 28.06.2007 “On approval of the Rules for execution of state ecological examination”
102.	Order of Ministry of Environmental Protection of RK No.238-п dated 25.07.2007	Rules for access to ecological information relating to the procedure of assessment of impact on the environment and to the process of decision-making for planned economic and other activities
103.	Order of Ministry of Environmental Protection of RK No.207-п dated 28.06.2007	Rules for execution of state environmental examination
104.	Order of acting Minister of Environmental Protection of RK No. 157-п dated 21.05.2007	Standards of maximum permissible concentrations of chemical agents in soil (while zoning and using lands of agricultural designation)
105.	Order of Ministry of Environmental Protection of RK No.135-п dated 07.05.2007	Rules for holding public hearings
106.	Order of Ministry of Environmental Protection of RK No.43 dated 13.02.2007	Forms of report on compulsory ecological audit
<i>Licensing and permits in the field of environmental protection</i>		
107.	Decree of Government of RK No. 123 dated 19.01.2012	On introduction of amendments to Decree of Government No. 457 dated 05.06.2007 “On approval of Rules for licensing and qualification requirements set out to the activity on implementation of works and provision of services in the field of environmental protection”

<b>1</b>	<b>2</b>	<b>3</b>
108.	Order of Ministry of Environmental Protection of RK No. 239-п dated 21.10.2003 “On execution of the current legislation in the field of licensing”	Instruction to qualification requirements to licensable types of activity on environmental desing, standardization and works in the field of ecological examination  List of works and services forming part of licensable types of activity on environmental design, standardization and works in the field of ecological examination.
109.	Order of Ministry of Environmental Protection of RK No. 192-п dated 01.07.2004 Included in the List of current regulatory legal acts in the field of environmental protection, Order of Ministry of Environmental Protection No. № 324-п dated 27.10.2006	On issuing a conclusion of environmental supervision for certain types of licensable works and services
110.	Joint Order of the Minister of Health of the Republic of Kazakhstan No. 824 dated 24.11.2004, Minister of Environmental Protection of the Republic of Kazakhstan No. 309-п dated 01.12.2004, acting Chairman of the Committee on Water Resources of the Ministry of Agriculture of the Republic of Kazakhstan 236-п dated 11.11.2004, Chairman of the Committee of Geology and Subsurface Resources Management of	Instruction on coordination and issuance of permits for special water use in the Republic of Kazakhstan

	the Ministry of Energy and Mineral Resources of the Republic of Kazakhstan 161-п dated 02.12.2004 registered at the Ministry of Justice of RK No. 3263 dated 13.12.2004	
<b>1</b>	<b>2</b>	<b>3</b>
111.	Decree of Government of RK No.508 dated 18.06.2007	Rules for issuance of permits for import, export of ozone-destroying substances and products containing them, execution of works with application of ozone-destroying substances, repair, installation, maintenance of the equipment containing ozone-destroying substances
112.	Decree of Government of RK No.457 dated 05.06.2007	Rules of licensing and qualification requirements to execution of works and provision of services in the field of environmental protection
113.	Decree of Government of RK No.95 dated 04.02.2008	Rules for issuance of complex ecological permits and list of types of industrial facilities, for which it is possible to obtain complex ecological permits instead of permits to emissions to the atmosphere
114.	Order of Ministry of Environmental Protection of RK No.112-п dated 16.04.2007	Rules for introduction of natural resources use conditions into permits to emissions to the atmosphere
115.	Order of Ministry of Environmental Protection of RK No.94-п dated 30.03.2007	Forms of documents for issuance of permits to emissions to the environment and rules for their filling out
116.	Decree of Government of RK No.631 dated 27.06.2008	On introduction of amendment to Decree of Government of the Republic of Kazakhstan No. 543 dated 27.06.2007

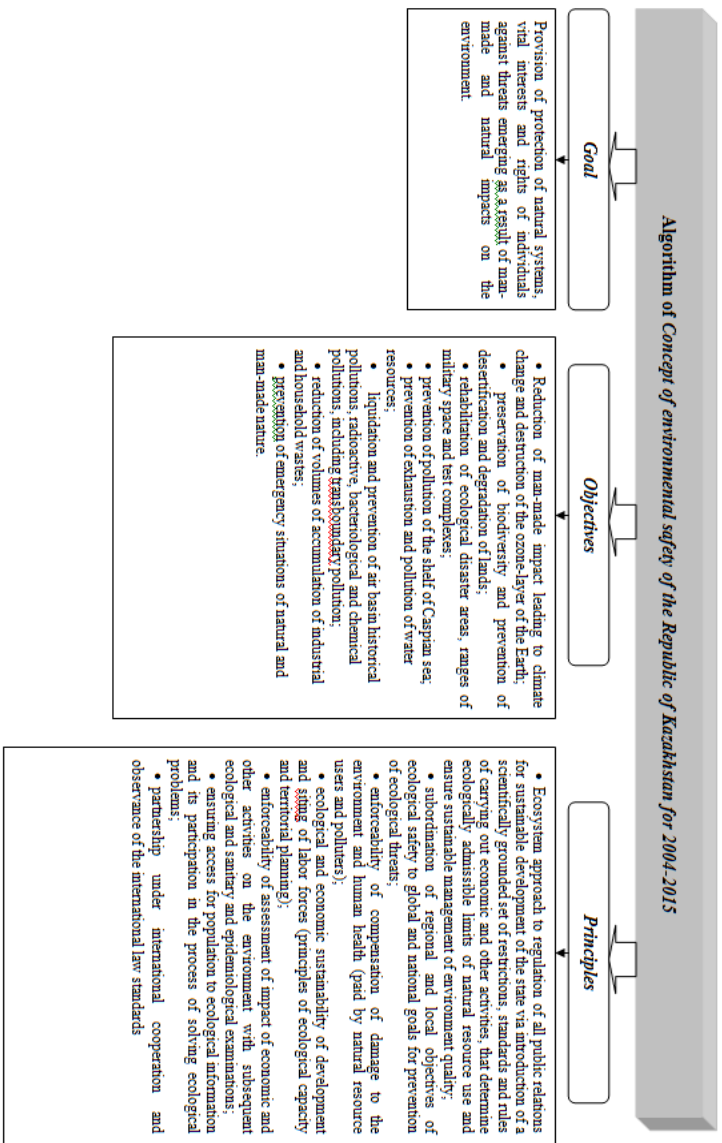
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117.	Decree of Government of RK No.245 dated 12.03.2008	List of the best available technologies
118.	Decree of Government of RK No.543 dated 27.06.2007	List of ecologically dangerous types of economic and other activities
119.	Order of Ministry of Environmental Protection of RK No.119-п dated 26.04 (Not subject to state registration – letter of MOJ dated 04.05.2007)	Typical list of measures on environmental protection
120.	Order of Ministry of Environmental Protection of RK No.252-п dated 06.08.2007	Rules for state record-keeping of natural resource users and sources of environmental pollution

In order to improve its own legislation, the Republic set a course for approximation with the legislation of developed countries and introduction of international standards. The Republic of Kazakhstan signed 19 international conventions and developed national action plans on their implementation. Ecological safety, as a constituent of national security, is an essential condition of sustainable development and serves as a basis for preservation of natural systems and maintenance of the adequate environmental quality. The Concept of Environmental Safety of the Republic of Kazakhstan for 2004-2015 was developed based on the priorities of “Kazakhstan 2030” Strategy and taking into account fundamental provisions of the Agenda and principles of Rio de Janeiro Declaration on environmental protection and development dated 1992, as well as the World Summit on Sustainable Development in Johannesburg (2002). Kazakhstan also ratified the Kyoto Protocol (1997), according to which the Republic took on the obligation to regulate quantitative emissions of greenhouse gases to the atmosphere.

Environmental pollution, landfilling, utilization and recuperation of wastes, reduction of arms, suspension of nuclear tests, destruction of nuclear, bacteriological and chemical weapons, changes in manufacturing technology, mastering of new “clean” sources of energy, non-waste production, and fight against poverty, food problems, illiteracy – all these problems bear an international nature.

International cooperation on natural resource use issues is executed on the basis of a number of principles:

1. Generally accepted rules of the international law.
2. Permanent sovereignty of nations over their natural resources.
3. Strict scientific validity of established international standards of rational nature use.
4. Inadmissibility of national nature use.
5. Inadmissibility of national appropriation of international areas.
6. Inadmissibility of impact on the environment for military purposes incompatible with the interests of nations.
7. Prevention of pollution of international areas.



**Figure No. 8**

In the group of specialized UN institutions, various aspects of the environmental problem are handled by the International Labor Organization (ILO), Food and Agriculture Organization (FAO), World Health Organization (WHO), International Civil Aviation Organization (ICAO), World Meteorological Organization (WMO), General Agreement on Tariffs and Trade (GATT). The International Atomic Energy Cooperation implements a large program on environmental protection.

As part of the assessment and distribution of information about the impact of chemical substances on human health and environment, an important role is assigned to the International Program on Chemical Safety (IPCS) approved by the Executive Committee of WTO. The Convention on Long-range Transboundary Air Pollution (CLRTAR) was signed in Geneva in 1979. The document stimulated the development of five specialized programs of international cooperation developed by the Working Group of UN European Economic Commission. The most important such programs are the Cooperation Program for the Monitoring and Evaluation of the Long-Range Transmission of Air Pollutants in Europe (EMEP), Program of Forest Monitoring (ICI Forest) and Program of Integral Monitoring (ICP IM).

The Concept of “Sustainable Development”, formulated by UN World Commission on Environment and Development, found its expression in the Concept of Environmental Safety of the Republic of Kazakhstan for 2004-2015. “Sustainable Development” assumes the improvement of life quality on one hand, and on the other hand – the provision of life safety, which, in its turn, assumes the preservation of population health and quality of the surrounding natural environment. According to this document, the country shall have a long-term complex and balanced solution for social and economic problems while preserving a favorable environment and natural resources, as well as while satisfying the needs of current and future generations of people.

The results of implementation of the Concept of Environmental Safety allowed to develop and implement a number of measures at the Republican level, and to develop and implement measures on state support and regulation in the field of

environmental protection and rational nature use. Moreover, regulatory legal acts have been developed in order to regulate the issues of environmental protection, environmental insurance, production and consumer wastes, environmental audit, and a single system of monitoring of the environment and natural resources has been created. State system for prevention and liquidation of emergencies has been developed, including a system of measures on reduction of emissions of greenhouse gases in the Republic. A set of legal measures on water saving, desertification control, internal migration of population and economic use of territories of ecological disaster zones, liquidation of historical pollutions, improvement of management of production and household wastes, on monitoring of environmental state of territories of ranges of military space and test complexes has been executed.

The practical implementation of the concept provisions at the very first stage allowed to maintain emissions and discharges to the environment and accumulation of production and consumer wastes at a stable level. The result of completion of all the planned programs shall be the achievement of the indicators of quality of natural environment locations and favorable level of environmentally sustainable development of community; simultaneously ensuring the reduction of the negative impact of man-made factors on the environment and generating an ever-efficient environmental quality management system.

#### 4.1. Environmental monitoring

It is commonly known that health of a human is formed under the influence of both internal – hereditary and, consequently, inherent to that individual, and external factors, whether favorable or harmful to health. In their turn, social living conditions have a big influence on the nature of external factors' impact degree.

Concentration of industry, transport, big masses of population, in case of its high density, in a restricted area assumes on its own a change of economic, social and hygienic, environmental and other living conditions. The latter leads to the necessity of an in-depth study of the role of environmental man-made factors in the

process of formation of population health. Multiple emissions of industry and automobile transport, discharge of waste waters to water bodies, processing of wastes and deposition of dust containing various and sometimes high-toxic to human substances determined the necessity in a complex approach to the problems related to environmental pollution and population health status. For this reason, ecological monitoring systems are developed in order to measure, assess and forecast responds of the biosphere to man-made load.

**Environmental monitoring** – is a system of space and time observations over environmental changes caused by man-made factors, allowing to assess and forecast the development of these changes,

According to UNESCO International Program “Man and Biosphere” adopted in 1974, monitoring is defined as “a system of regular long-term observations, measurements and assessment of environmental conditions according to the pre-arranged and scientifically grounded program allowing to forecast the future change of environmental parameters that are particularly important to mankind”.

Natural, man-made or natural-man-made ecosystems can be monitoring objects.

*The objectives of environmental monitoring include:*

- supervision over sources of man-made impact;
- supervision over factors of man-made impact;
- supervision over changes occurring in the environment under man-made impact;
- supervision of health status of the population living in areas under impact of man-made factors;
- analysis of data, assessment and forecast of changes in the state of natural environment as a whole or of its individual components under the impact of influencing factors;
- development of systems of management and optimization of man-made impact on the environment.

The monitoring system shall perform both local tasks of supervision over the state of individual ecosystems or fragments (for instance, biotas), and tasks of planetary significance, i.e. provide a

global monitoring system. Environmental monitoring is a hierarchically arranged system of observations that is composed of links of various levels. Thus, by scope of observations and nature of information collation, the following types of monitoring are distinguished:

- *global (biospheric) monitoring*, implemented on the basis of international cooperation that is becoming more intensive in recent years;
- *national monitoring*, implemented within a state by specially established bodies;
- *regional monitoring*, implemented within intensively developed large regions, for instance, within territorial production complexes;
- *local (bioecological) monitoring*, including supervision over changes of environmental quality within residential areas, industrial centers, directly at enterprises;
- *impact monitoring*, implemented in highly hazardous zones and places.

Monitoring systems used for supervision over the transport of pollutants in the interests of a few regions or countries are defined by term *transboundary monitoring*.

According to the specificity of methods of measurement and information assessment, biological, geochemical, geophysical monitoring etc. are distinguished. According to the specificity of supervision and protection facilities, there is monitoring of atmosphere, soils, surface waters (hydrological), underground waters (hydrogeological), plant resources (geobotanical), forests, animal world, man-made, transport and recreational load, medical and demographic monitoring etc. (Table No. 6).

**Table No. 6.** Classification of monitoring systems (subsystems).

<b>Classification principle</b>	<b>Current or developed monitoring systems (subsystems)</b>
Universal systems	Global monitoring (basic, regional, impact levels), including baseline and paleontological monitoring. National monitoring (for instance, nationwide service of supervision and control over the level of pollution of the external environment). International monitoring (for instance, monitoring of transboundary transportation of pollutants)
Respond of main constituents of the biosphere	Geophysical monitoring Biological monitoring, including genetic monitoring Ecological monitoring (including the foregoing)
Various environments	Monitoring of man-made changes (including pollutions and respond to them) in the atmosphere, hydrosphere, soil, cryosphere and biota
Impact factors and sources	Monitoring of pollution sources Ingredient monitoring (for instance, monitoring of individual pollutants, radioactive emissions, noises etc.)
Acuteness and global nature of the problem	Ocean monitoring Monitoring of the ozonosphere
Supervision methods	Monitoring by physical, chemical and biological indicators Satellite monitoring (remote methods)
Systematic approach	Medical and biological (health status) monitoring Environmental monitoring Climate monitoring Alternative: bioecological, geoecological, biospheric monitoring

Monitoring systems can be classified by supervision methods (for instance, by physical and chemical, biological, geographical etc.).

Remote monitoring shall be specially noted (remote indication of ecological systems).

Aerospace methods are applied for inventory and mapping of natural resources, supervision of seasonal and long-term changes of the natural environment, tracking of its content and state, as well as of consequences of human economic activity impact.

As part of the international cooperation on control over the state of surrounding natural environment, by efforts of the international community, the single Global Environmental Monitoring System (GEMS) was created in 1974. The territories of different countries of the world accommodated watch stations integrated into a single system that allows to track the levels of content of a number of pollutants and highly hazardous toxicants in the atmosphere, waterbodies, as well as to collect information on the state of natural resources, soil and forest cover etc. GMES widely applies remote sensing and geoinformational technologies. Classes of pollutants were distinguished by the principle of priority and their relevant monitoring levels were defined.

The basis of monitoring in separate countries are national monitoring systems organized in various states according to the common principles and including mandatory supervision and submission of information on facilities of global significance to the center. By Decree of the Government of the Republic of Kazakhstan No. 885 dated 27.06.2001, the Rules for organizing and keeping the Single State System of Monitoring of the Environment and Natural Resources, which goal is to ensure information support for making management and economic decisions, control over natural resource use, information of population on environmental state and impacts of environmental factors on population health, were approved.

By Order of the Ministry of Health of RK No. 135 dated 09.02.2004, the Rules for execution of sanitary and epidemiological monitoring were approved, which goal is to organize a system of supervision over population health status and living environment, their analysis, assessment and forecast, as well as to define cause-

effect relationships between population health status and living environment factors. The territorial monitoring executed by bodies of state sanitary and epidemiological service is divided into the republican, regional and local levels. The territorial bodies of environmental protection, according to the approved Rules for keeping the state register of pollution areas (Decree of the Government of RK No. 566 dated 03.07.2007), form the State register of pollution areas (data bank) collecting the data on types and origins of pollution areas, volumes and concentration of pollutants, economic nature of pollution areas and measures on their liquidation.

Besides the state monitoring, there is also production monitoring and public monitoring.

*Production monitoring (environmental audit)* – assessment of an enterprise activity from the point of view of safety for environment.

*Public environmental monitoring* – ensures the creation of an alternative information channel and increase of environmental control efficiency; supervision of the facilities, which are either not included in the program of monitoring of state environmental protection services, or described in an insufficient manner; attraction of attention to problems that were not outlined before; development of environmental education and awareness.

#### **4.2. Medical and environmental standardization and zoning**

In the modern conditions, the degree of protection of natural environment and vitally important interests of humans against the negative impact of economic and other activities, emergency situations of natural and man-made nature, and their consequences, comes into sharp focus. As a result of the man-made impact, the environment takes the features of aggressivity with an ever-increasing frequency and, according to the opinion of experts, during the coming 20-30 years the population health status, together with social conditions, will be primarily determined by the environment quality.



In order to preserve the physiographic basis of geobiocoenosis and optimal mode of operation of natural-man-made complexes, it is necessary to introduce ecological standardization systems into the practice of natural resource use. Environmental standardization assumes the development of limit and gradational values of the performance of a surrounding natural environment or technological process that are established according to the criteria of compliance with the normal environmental state.

The environmental standardization system is aimed at:

- legal regulation of relationships in the field of natural resource use and nature preservation;
- creation of standards for the state of individual natural environments and natural environment as a whole;
- creation of standards for organization of technological processes according to the nature protection requirements – MPE, MPD, and waste disposal limits etc.

In the Republic of Kazakhstan, the medical and environmental standardization is executed in the following directions:

- state of biotic components (soils, plant cover and animal world) according to the criterion of their compliance with zonal natural conditions and traditional, historically developed natural resource use of the region;
- dependence of population health status on the state of surrounding natural environment.

Determination of the permissible limit of natural environment damage up to the preservation of its self-regeneration ability at a given level of natural resource use laid the foundation of environmental standard establishment.

By Decree of the Government of RK No. 653 dated 31.07.2007, the *Criteria for assessment of environmental situation of territories* were approved. The criteria for assessment of environmental situation of territories represent a complex of indicators characterizing deterioration of population health status and environmental state. The criteria for assessment of environmental situation of territories are used while determining an environmental disaster zone and emergency environmental situation zone. By

Decree of the Government of RK No. 431 dated 05.05.2004, the *Rules for declaration of an emergency environmental situation* were approved. According to these Rules, the borders of territories subjected to various degrees of degradations are determined, population health status is evaluated in conjunction with indicators of environmental pollution. The assessment of caused economic and medical and social damage, possibilities of expansion of an emergency environmental situation, and a set of measures on its liquidation are carried out.

The methodological framework of formation of the above-mentioned documents consisted in the integrated assessment of environmental problems of territories in the following respects:

- assessment of natural environment state, which can be characterized through the indicators of pollution of air, water, soil, degradation of ecosystems on the basis of general ecological and sanitary requirements;
- assessment of living environment state that is characterized through sanitary-hygienic standards and requirements to cleanness of water use sources, fishery waterbodies, forested and agriculturally used areas, as well as of ambient air;
- assessments of medico-genetic and medico-demographic indicators of the health status of adult and children population.

As it is known, one of the main features of population welfare is considered to be health. Being a part of the natural-man-made system, the population safety is defined by the sustainability of development and operation of all components of this system. Human safety is a degree of his/her protection against potential damage to life quality, health, welfare.

Consequently, the medico-ecological assessment of environmental quality and population health can be interpreted as a scientifically grounded definition of the role of various environmental factors and their combinations under the conditions of a specific natural-man-made system and its influence in terms of spread of different diseases.

In general terms, the system of medico-environmental zoning can be presented as including the following main stages:

- identification of peculiarities of the demographic situation in a region (taking into account the ratio of urban and rural population, its density, birth rate, mortality etc.);
- population health status (taking into account the disease distribution, age and occupational peculiarities etc.);
- zoning of the territory according to the indicators of climate comfort;
- identification of natural backgrounds of emergence of endemic diseases (hydrochemical peculiarities of drinking water, soils, grounds etc.);
- identification of quality and quantitative characteristics of the man-made pollution of components of the surrounding natural environment;
- study of sustainability of ecosystems under the impact of man-made factors;
- identification of the correlation dependence between the environment quality and resident population health status;
- medico-environmental zoning of the territory and complex assessment of environmental state and health of various population categories.

Currently, the methodology and methods of medico-environmental surveys are in the process of constant improvement. The obtained results of medico-environmental surveys serve as a basis for adjustment of environment monitoring systems, introduction of various sanctions to natural resource users, and for the development of complex medical and sanitary-hygienic measures.

The distinguishing feature of medical ecology compared to other disciplines related to environmental protection is the assessment and protection of human health and conditions of his/her life. The necessity of integration of medico-environmental knowledge is particularly felt while moving to the population level of studying the population health status, since it is exactly this level, at which the negative impacts of individual elements of the environment are leveled out and their joint impact has an effect to the maximum extent.

In terms of social medicine, there are 3 levels of health assessment:

- health of an human (individual);
- health of small social, ethnic groups (family or group health);
- health of the total population living in a city, village, at a certain territory.

While assessing the population health, the medical statistics uses typical medico-demographical indicators:

- Indicators of natural population movement:
  - overall and age-specific mortality;
  - birth rate and fertility;
  - natural population growth.
- Indicators of mechanical population movement: migration of population (emigration, immigration, seasonal, intra-city migration etc.).
- Indicators of morbidity and prevalence proportion.
- Indicators of disability and disability index.
- Indicators of physical development of population.

It should be noted that functional capabilities of organism and its resistance to negative factors of the external environment substantially change throughout life, for this reason we can speak about health status as a dynamic process that can be improved, i.e. about promotion or decay of health. Indicators of health of an individual characterize his/her physical and social levels in the community.

Of the entire variety of indicators, the *indicators of health of population* can be as follows:

- expected duration of a coming life (for males, females, urban population, rural population (at birth, at the age of 15, 45 and 65 years));
- mortality (general and standardized indicators; mortality due to cardiovascular diseases, malignant neoplasms and other diseases);
  - infant mortality;
  - share of infants weighing less than 2500 g at birth (1000 g);
  - indicators of physical development of children;
  - morbidity (overall, occupational, with temporary disability), cancer morbidity, morbidity of individual organs and systems, according to ICD-10;

- frequency of congenital malformations;
- infectious morbidity.

Health can be characterized quantitatively by the number of years lived without serious extended diseases. Average length of life of a human (T) is typically estimated at 100 years. Frequency of deaths  $\lambda$  is equal to  $1/T$ . Individual death probability during a year for rare events R is equal to the mathematical expectation of the number of deaths for  $\Delta t = 1$  year:

$$R \approx \lambda \Delta t = 10^{-2}, 1/(\text{person} \cdot \text{year}).$$

The improvement of health both of an individual and of population as a whole, as well as the growth of longevity contribute to establishment of the status of dynamic equilibrium and stabilize the sustainability of society development.

## Chapter 5 FUNDAMENTALS OF ASSESSMENT OF RISK TO POPULATION HEALTH

At the current stage of society development, there is no doubt that a negative environmental background has an adverse effect on formation of population health, especially due to the change of social and economic conditions and loosening of control over the quality of living environment on one hand, and on the other hand – due to the emergence of new synthesized chemical compounds which a human has a direct contact with and to which he/she is not evolutionary adapted, what determines a high risk of development of negative consequences both for population as a whole and for each individual. Today, risk analysis, from the solely practical instrument initially developed for justification of management decisions, transformed into one of the most important elements of assessment not only of negative impact and hygienic standardization of environmental factors, but of the entire human ecology as an integrating, interdisciplinary science on interactions of human with living environment, as well as a new section of medical science under formation – occupational medicine [32-36].

**Assessment of risk to human health** – is a quantitative and/or qualitative characteristic of adverse effects that are able to develop as a result of impact of the human living environment factors on a specific group of people under specific exposure conditions.

The territory of the Republic of Kazakhstan accommodates large production complexes of chemical industry, ferrous and non-ferrous industry, military firing ranges for testing missile and other weapons, uranium ore extraction mines, plants of oil and gas extraction and their processing, agricultural enterprises etc. These led to the generation of an environmental situation at the majority of territories of the Republic classified as environmental disaster zones. These pollutions have a complex and combined impact on population related to various ways of influencing human organism.

Today, environmental changes have moved to a qualitatively new level. The development of industry, transport, increase of energy production and consumption, intensification and chemicalization of

the agricultural economy, living conditions, urbanization and growth of cities, creation of territorial production complexes lead to the environmental pollution level that already has a direct impact on health and morbidity of population of various regions of the country.

The previously applied principle of regulation of individual environmental factors on human organism led to the situation where there are thousands of maximum permissible concentrations, and parameters, levels of impact of chemical, physical and other environmental factors (developed for water, ambient air, soil, food products, technological environment) on human organism that currently do not allow us to assess the specific level of their joint impact on health status and morbidity of population at a combined impact of specific factors in a given region.

At the present moment, the concept of “assessment of risk” to population health due to the impact of human living environment factors has come into widespread application. However, the complicated social and economic conditions led to a substantial suspension of development of these theoretical issues in national science.

The “risk assessment” concept is based on determination of an individual and collective (population) risk of emergence of a diseased condition under the impact of negative factors of the living environment.

The individual risk of emergence of a diseased condition of organism is determined by the average value of dose load and set of negative environmental factors having an impact on a specific human within 24 hours (occupational activity, living conditions, outdoor recreation etc.).

The population risk of emergence of a disease can be determined as a level of health status and morbidity of a specific population group based on pro rata contribution of negative impacts of all factors of the environment of a population in question according to occupational, social, age-specific, ethnic and other indicators of its structure.

On the basis of the foregoing, it is arguable that the morbidity level of population of a specific settlement is an integrating value that includes occupational and production induced morbidity of

workers of leading enterprises of that region, environmentally and socially induced diseases, other conditions and diseases of population taking into account age, sex, ethnic composition and other peculiarities of this population (Table No. 7).

**Table No. 7.** Factors influencing the population level of health status and morbidity of population of a region.

<b>Living environment factor</b>	<b>Health status and disease prevalence</b>
1. Occupational activity	1.1. Occupational diseases.
2. Environmental living conditions	1.2. Production induced diseases and health conditions of workers.
3. Natural and climatic conditions of population living	2.1. Specific diseases induced by environmental pollution.
4. Social and living conditions of population and genetic background	2.1. Increase of the level of somatic and infectious diseases under the impact of environmental pollution.
	2.3. Environmentally induced diseases.
	3.1. Diseases and conditions induced by the quality of meteorological conditions and climate while changing domicile.
	3.2. Diseases and conditions induced by the presence of natural geochemical provinces.
	3.3 Natural focal and parasitic diseases.
	4.1. Diseases and conditions induced by psychological stresses and degree of population urbanization.
	4.2. Morbidity and conditions related to hereditary factors.

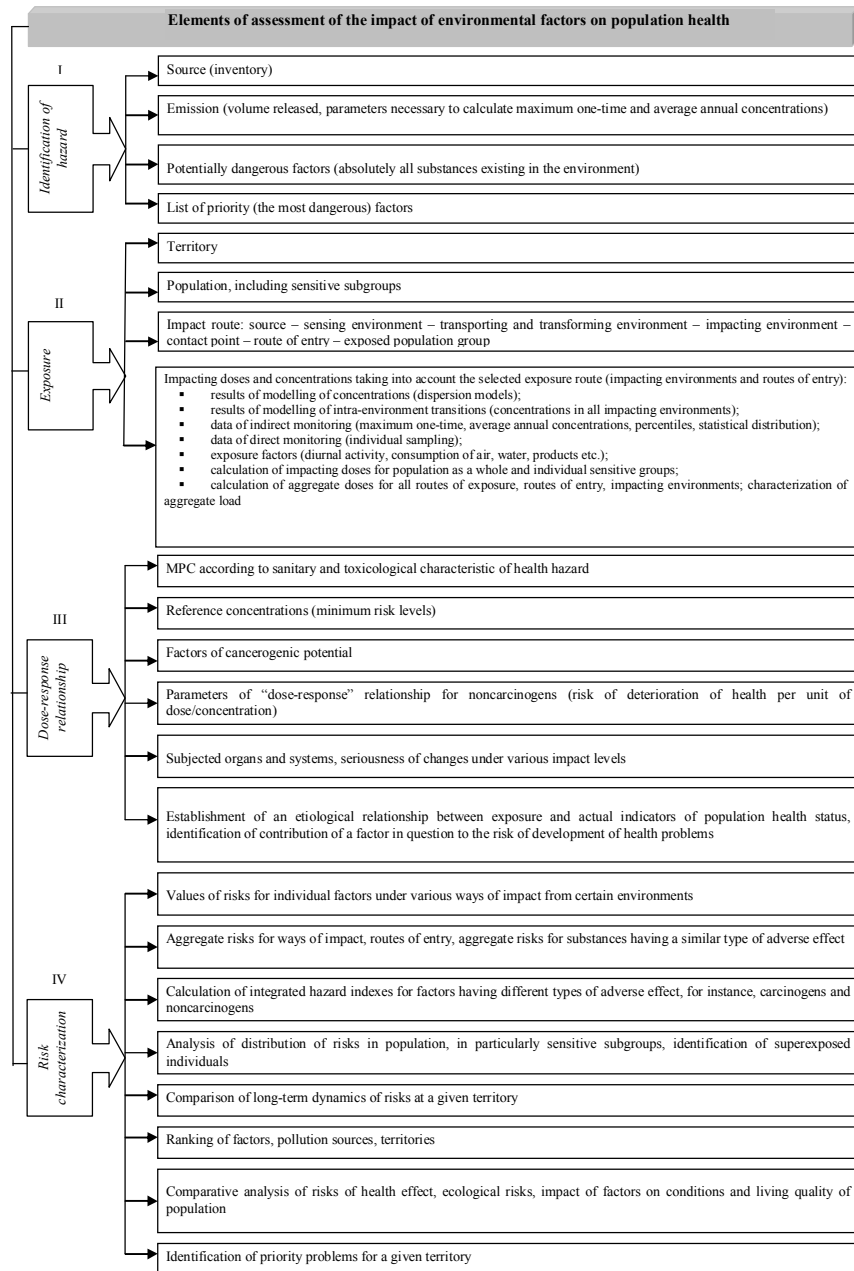
Term “risk” entered into occupational medicine together with the recommendation of the International Organization for Standardization (ISO-1999, 1971). The International Labor Organization adopted Convention No. 148 “Concerning the

Protection of Workers against Occupational Hazards in the Working Environment Due to Air Pollution, Noise and Vibration” (1997). The concept of risk is reflected in scientific developments and documents of International Organizations (WHO, Organization on Economic Cooperation and Development, UN Environment Programme (UNEP), Concept of European Community). The methodology of assessment of risk to human health under the impact of environmental harmful factors developed by US Environmental Protection Agency (EPA US) has gained the most widespread application.

The risk assessment system includes 4 stages:

1. *Identification of hazard*. The objective of this stage is to identify specific chemical substances potentially capable of causing negative effects. First of all, however, the most toxic compounds posing the highest threat to human health are sampled.
2. *Assessment of exposure* is acquisition of information on what types of actual chemical loads various population groups encounter.
3. *Assessment of “dose-response” relationship* - is the search of quantitative consistent patterns between doses of substances received by population and cases of adverse effects in exposed populations. In general, the consistent patterns sought for are identified in toxicological experiments on animals, however, the complexity of their extrapolation to human population is related to the multitude of uncertainties. Therefore, the “dose-response” relationships justified by epidemiological data are considered to be more reliable. MPC (maximum permissible concentration) system and EPA (USA) methodology are the most frequent practically used characteristics of dose-response relationships in preventive medicine.
4. *Risk characterization* - is a final stage integrating all the previous stages of risk assessment and drawing final conclusions. This stage of the analysis gives the assessment of risks caused by chemical pollution of individual environments (inhalational impact of ambient air pollutions and ingestion intake of a substance with drinking water). For each environment, the values of risks are computed will all possible ways of entry of a substance to organism (inhalational, peroral, and epidermal). The values of risks for each environment and route of entry are totalized and the total value of aggregate load for

each substance is calculated. The calculations of risks are carried out separately for carcinogenic and non-carcinogenic effects.



Average daily dose of a chemical substance entering human organism throughout lifetime is calculated as follows:

$$LADD = (C * CR * ED * EF) / (BW * AT * 365),$$

where:

*LADD* – average daily dose or entry (mg/(kg\*day))

*C* – concentration of substance (mg/m<sup>3</sup>, mg/l)

*CR* – contact rate (m<sup>3</sup>/day, l/day)

*ED* – exposure duration (years)

*EF* – exposure frequency (365 days)

*BW* – body weight (kg)

*AT* – averaging time (70 years)

365 – number of days in a year.

All formulas for individual routes of entry of chemical substances have a common structure and contain the correction factors necessary for conversion of units of weight, volume and area. Standard values of contact rate, exposure duration and frequency are recommended for each route of entry of chemical substances.

In EPA methodology, the assessment of dose-response relationship is divided for carcinogens and noncarcinogens:

- for carcinogenic substances, it is assumed that adverse effects can emerge at any dose, causing damage of genetic material;
- for noncarcinogenic substances there are threshold levels and it is assumed that adverse effects do not emerge at the level below the thresholds.

According to EPA method, the minimum risk levels – *reference doses (RfD)* and *reference concentrations (RfC)* of chemical substances – are most frequently used for characterization of the risk of development of noncarcinogenic effects. The more an impacting dose exceeds a reference one, the higher is the probability of emergence of adverse responses. Total indicators of exposure assessment on the basis of reference doses and concentrations are called *hazard quotients (HQ)*.

### Calculation of carcinogenic risks

**Individual carcinogenic risk (ICR)** – is the assessment of probability of development of an exposed individual's malignant neoplasm under the impact of carcinogen throughout lifetime.

**Population carcinogenic risk (PCR)** – is the expected frequency of effects among the entire population subjected to carcinogenic impact (set for annual exposure);

The value of an individual lifetime carcinogenic risk (ICR) is calculated by means of multiplying the chronic average daily dose (or average daily entry) (CDI) by SF value (cancer slope factor, see Annex 2):

$$ICR = CDI \cdot SF$$

$$PCR = ICR \times \text{population number}$$

Under the impact of a few carcinogens, the aggregate carcinogenic risk for one route of entry (inhalational) is calculated according to the following formula:

$$CR_u = \sum CR_i,$$

where:

$CR_u$  – total carcinogenic risk for inhalational entry

$\sum CR_i$  – aggregate of carcinogenic risks for i-carcinogenic substances.

Table No. 8. Table of risk levels.

Risk level	Total risk ratio	Measures
Highly dangerous	$>10^{-1}$	Urgent curative measures
High	$>10^{-3}$	Planned curative measures
Average	$10^{-3}-10^{-4}$	Admissible at an occupational level, inadmissible for population
Low	$10^{-4}-10^{-6}$	Majority of international standards are established
Admissible	$<10^{-6}$	Measures not required

### Calculation of noncarcinogenic risks

Characterization of the risk of development of noncarcinogenic effects is carried out on the basis of calculation of the hazard quotient – HQ:

$$HQ = C_{actual} / RfC,$$

where

$C$  – actual concentration of a substance in air

$RfC$  – reference concentration (see Annex 2).

With HQ equal to or less than 1,0, the risk of adverse effects is considered as small as possible, with the growth of HQ the probability of development of adverse effects increases.  $HQ > 1,0$  is considered as the evidence of potential risk to health. Hazard index (HI) for a complex (from a number of environments) route of entry is calculated according to the following formula:

$$HI = \sum HQ,$$

where:

$\sum HQ$  – aggregate of hazard coefficients for individual routes of entry or individual routes of impact.

Detection and identification of the entire aggregate of environmental pollutants is a quite complex and time-taking process. In this regard, it seems advisable to outline specific criteria of priority of various chemical compounds according to their biotransformation and toxicometric parameters.

### Criteria of priority of chemical substances

#### Primary criteria

1. Amount of substance reaching the environment.
2. Persistence characterized by the period of half-existence of a chemical substance in environmental locations. The chemical compounds with the period of half-existence of more than 50 days are classified as persistent.
3. Bioaccumulation reflecting the ability of a substance to move from environment to biological objects (for instance, aquatic

organisms). Chemical compounds with the coefficient of bioaccumulation for fish more than 500, and substances which logarithm of octanol/water propagation coefficient exceeds 4,0 are classified as bioaccumulable.

4. Capacity of a substance for cross-media distribution and transport, migration from environment to other environments. Simultaneous pollution of a few environments, spatial distribution of pollution.
5. Hazard to human health, including delayed and irreversible effects.
6. Toxicity to organisms in the environment (aquatic and terrestrial animals).
7. Other effects: damage of chemical processes in the atmosphere, change of environmental response (pH), and presence of unusual properties, for instance, chelating ability, damage of the atmosphere transparency, blooming of waterbodies etc.

#### **Criteria for exclusion of chemical substances from the list of risk assessment priority substances**

1. Unavailability of the results of measurements of concentrations of a substance or unreliability of available data, if within this project it is not possible to assess exposure levels by any means even tentatively.
2. Inorganic compounds whose concentrations are lower than natural background levels (for instance, iron, calcium etc.) can be also excluded from the preliminary comprehensive list.
3. Detection of a substance only in one or two environments, in a small number of samples, in low concentrations compared to reference impact levels (hygienic standards), the value of hazard quotient (HQ) is substantially less than 0,1, and the carcinogenic risk is less than  $10^{-6}$ . Under the combined impact with other chemical compounds having a homogeneous effect and/or impacting the same organs or systems, the exclusion of this compound shall not lead to a substantial reduction of the aggregate hazard index (HI).
4. Absence of express toxicity and suspicions regarding carcinogenic activity to human.

5. Absence of adequate data on biological action of a substance, when it is not possible to forecast its probable indicators of toxicity and hazard at least tentatively (for instance, via the analysis of relationships “chemical structure – biological activity”, extrapolation from other routes of entry to organism or another exposure duration etc.).

#### **Hygienic assessment of professional risk**

Occupational medicine typically takes into account not only health, but also social welfare of a worker. While identifying occupational risk levels, the assessment of labor conditions of workers according to hygienic criteria is a priori, preliminary, and, consequently, tentative, whereby it shall be backed up by a posteriori, final risk assessment. The resulting features of impact of negative occupational factors on workers' organisms include health status, occupational and occupationally induced morbidity, as well as integral indicators calculated on their basis.

In the light of contemporary concepts of WHO and ILO, the criteria of safety of labor conditions in a production environment are the preservation of health, functional capacities of organism, duration of coming life and health of future generations.

In this connection, occupational risk can be defined as a risk to life and health related to labor activity. It includes the risk of: a) death as a result of violent or chronic action of occupational hazards irrespective of disease duration, in case of tracing a connection with occupational activity; b) injuries; c) occupational diseases caused by the impact of factors related to professional occupation and emerging for the period exceeding one working day or shift.

A priori assessment of risk is carried out according to the hygienic criteria of assessment of labor conditions, indicators of hazard and danger of factors of technological environment, heaviness and stress nature of a labor process.

A posteriori assessment of risk is carried out according to medicobiologic indicators: occupational morbidity, level of morbidity with temporary disability, including decrease in reproductive health and health of posterity, increase of biological age compared to chronological age etc. Sometimes it is possible to



forecast the probability of development of occupational diseases, for instance, caused by the impact of noise, vibration, dust load according to ISO standards and national models, via comparison of actual and estimated data.

In work experience dynamics, we can outline three zones of the risk of occupational disease development: safe, where the work experience exposure is small and, probably, yet is not dangerous and is permissible, while there is no reasoned information on health problems, but requires a certain attention; borderline, where the work experience exposure exceeds the permissible level, is hazardous, since a specific number of workers have health problems, and requires a careful attention; dangerous, where the work experience exposure is excessively high, there is a high frequency of occupational diseases, inadmissible by medical and social damage.

It is commonly believed that an occupational work experience exceeding the half of the average period of occupational disease development in this occupation is a significant risk factor. Such assessment analyses allow identifying the probable duration of contact while working in hazardous conditions that is safe to human health, as well as the terms of its reconsideration. It is undisputable that preventive measures, including protection via time (schedule of work and rest, shortened working day and additional leave), increase the safe work experience.

It is useful to apply the concept of assessment of occupational diseases by categories of their risk and seriousness, including the ranking of categories, both risk element and severity, as well as the one-digit index combining both indicators, what allows assessing various nosological entities.

In recent years, the concept of *evidence based medicine* has been obtaining an increasing widespread application, which uses mathematical and statistical approaches and epidemiological data that are necessary in order to introduce computer technologies to medicine. If risk assessment is a process of establishment of relationships between exposure and effects, analysis and interpretation of data, then risk management includes decision-making and actions, and thus, finds its way into technosphere. To ensure efficient risk management, it is necessary to take into account

the probability of emergence of an effect, severity of consequences, reversibility of effects, scientific uncertainty of risk assessment, possibility to control a risk, benefit clarity, justice and trust to authorities.

By Order of the Minister of Health and Social Development No. 454 dated 4 June 2015, "*The plan of measures on introduction of the Methodology for early detection of risk groups and prevention of occupational diseases*" was approved. According to this methodology, the early detection of risk groups and prevention of occupational diseases are carried out in the process of scheduled medical examinations of working population. Furthermore, the sequence of executed measures is divided into 3 stages: 1) production and hygienic monitoring of labor conditions and functional health status of workers; 2) individual assessment of functional health status of a worker; 3) implementation of individual and group preventive programs (Annex).

In the analysis of occupational morbidity, relative indicators are calculated both by the number of the affected and by the number of occupational diseases (intoxication), since one worker may be revealed to have two or more occupational diseases emerged under the impact of a few adverse factors. The intensive indicator of the frequency of newly discovered annual occupational diseases represents a ratio of the number of persons having newly discovered occupational diseases to the total number of persons of a given occupational group. The occupational morbidity index reflects not only frequency, but also severity of occupational diseases (Tables No. 9, 10).

While identifying intensive indicators of occupational morbidity, the number of workers subject to scheduled medical examinations in a specific occupation or engaged in similar labor conditions shall be used as a basis.

The occupational morbidity is analyzed for the period of 5-25 recent years, since the pathology accumulated for a few years gives a more objective reflection of the state of occupational morbidity for a given cohort. The impact of occupational factors on workers can manifest itself as the growth of both general and

chronical diseases, and the identification of occupationally induced morbidity is the most acceptable under the current conditions.

It is known that the impact of negative labor conditions on workers can manifest itself as the growth of the number of general somatic chronic diseases, reduction of life duration, senilism, increase of mortality rate etc. The morbidity with temporary disability (TD) and prevalence of chronic pathology reflects the occupationally induced morbidity to a certain extent.

Analysis of morbidity with TD for risk identification is recommended to be carried out not only by the line of total diseases, but also by individual disease groups, since it allows to reveal diseases induced by labor conditions.

Indicators of occupational morbidity, morbidity with TD, disability, mortality registered by the official statistics are the result of a complex impact of various factors of labor conditions and, in terms of the theory of occupational risk assessment, are related to the category of a posteriori characteristics. Special attention shall be paid to the problem of occupationally induced diseases in terms of solving methodical issues of assessment of such health problems for social protection of the affected workers. To take preventive measures, it is necessary to carry out a medicobiologic assessment of the impact of negative workplace factors on health and performance capability with application of hygienic criteria for assessment of conditions and nature of labor.

**Table No. 9.** Occupational morbidity risk categories.

Class of labor conditions	Medicobiologic indicators		
	Total morbidity indicator	Morbidity with temporary disability	L, years
Hazardous (3.1.-3.2.)	Less than 0,3	Above average	Up to 3-5
Highly hazardous (3.3.-3.4.)	0,3-1,0	High	5-10
Dangerous (extreme) (4)	More than 1,0	Very high	More than 10

**Table No. 10.** Criteria of occupational risk by health indicators.

Indicators	Occupational risk levels					
	Minimum	Low	Average	Above average	High	Extra high
Classes of labor conditions by degree of hazard and danger	2	3,1	3,2	3,3	3,4	4
Integral indicator	<30	30-100	101-300	301-1000	1001-3000	>3000
Integral indicator of occupational diseases $I_{oc}$	<0,1	0,1-0,5	0,51-1,5	1,51-5,0	5,1-15,0	>15
Index of occupational morbidity $I_{om}$	<0,05	0,05-0,1	0,11-0,25	0,26-0,5	0,51-1,0	>10
Occupational morbidity (number of cases per 10000 workers of a given occupation, production per annum)		=<1,5	1,6-5,0	5,1-15,0	15,1-50	>50
Morbidity with TD by all diseases (per 100 workers): - disability cases - disability days	66,4-72,3 867-938	72,4-84,6 939-1081	84,7-90,7 1082-1153	90,8-96,8 1154-1225	96,9-102,9 1226-1281	>102,9 >1281
Occupational induced morbidity (number of cases per 100 workers of a given occupation)	Depending on the nosological entity and degree of occupationally induced nature (by the relative risk of etiological share etc.)					

### Criteria for risk assessment in the field of industrial safety

By Joint Order of the Ministry for Emergency Situations of RK No. 50 dated 15.02.2010 and Ministry of Economy and Budget Planning of RK No. 49 dated 11.02.2010, the Criteria for assessment of risk degrees and check lists in the field of industrial and fire safety were approved. The recent criteria were developed according to the laws of the Republic of Kazakhstan “On industrial safety of hazardous production facilities”, “On fire safety” and Law on “Private entrepreneurship”.

**Criteria for assessment of degree of risks** – is a complex of quantitative and qualitative indicators allowing assigning enterprises and hazardous production facilities to various degrees of risk.

Depending on a risk degree, enterprises and hazardous production facilities were assigned to the degrees of high, average or insignificant risk, with scheduled inspections no more frequently than:

*one time per annum* – at high degree of risk of facilities;

*one time per three years* – at average degree of risk of facilities;

*one time per five years* – at insignificant degree of risk of facilities.

Risk groups of hazardous production facilities are distributed in the following sequence:

high degree of risk – facilities, where man-made emergency situations may occur;

average degree of risk – facilities, where an emergency, incident causing suspension of technological process and harm to life and health of operational personnel may occur;

insignificant degree of risk – facilities, where an emergency, incident causing damage of technical equipment and harm to life and threat of operational personnel may occur.

The high degree of risk is assigned to facilities, where an emergency situation of man-made nature may occur with the availability of the following technological processes and hazardous substances:

- liquid-alloys of ferrous and nonferrous metals and alloys on the basis of these liquid-alloys, mining, geologic exploration, drilling

(including on sea shelves and internal waterbodies), blasting operations on extraction and processing of mineral resources, works in underground conditions, sources of radioactive and ionizing emission, hydraulic engineering structures of hazardous production facilities, arms and munition;

- development, production, use, processing, storage, transportation, destruction of hazardous substances (Table No. 11).

Average degree of risk is assigned to facilities, where an emergency, incident causing suspension of technological process may occur while developing, producing, using, processing, storing, transporting and destructing hazardous substances.

Insignificant degree of risk is assigned to facilities, where an emergency, incident causing damage of technical equipment may occur with the availability of the following technical equipment:

- technical equipment operating under the pressure of more than 0,07 MPa or under the water heating temperature exceeding 115 Celsius degrees;

- lifting mechanisms, escalators, cableways, cable-railways, elevators;

- electrical installations of all types applied at hazardous production facilities.

In the process of liquidation or reduction of a damaging action of a hazardous production factor that served as the basis to assign the facility to a higher risk group, the facility moves to a group with a less degree of risk.

Inspections in one group start with facilities having a trend towards the growth of indicators of emergency situations of man-made nature, accidents and incidents.

**Table No. 11.** Distribution of production facilities by degree of risk depending on the number of a chemical substance contained.

For <u>high degree of risk</u> – more (tons)	For <u>average degree of risk</u> – less (tons)
Ammonia	10
Ammonium nitrate (ammonium nitrate or ammonium mixtures, in which the content of ammonium nitrate nitrogen is 28% of the weight, as well as ammonium nitrate water solutions, in which the concentration of ammonium nitrate concentration exceeds 90% of the weight)	1 250
Ammonium nitrate in the form of fertilizers (simple fertilizers on the basis of ammonium nitrate, as well as complex fertilizers, in which the content of ammonium nitrate nitrogen is more than 28% of the weight (complex fertilizers contain ammonium nitrate together with phosphate and (or) potassium))	5 000
Acrylonitrile	200
Chlorine	10
Ethylene oxide	50
Hydrogen cyanide	20
Hydrogen fluoride	50
Hydrogen sulphide	50
Sulfur dioxide	200
Sulfur trioxide	75
Lead alkyls	50
Phosgene	0,75
Methylisocyanate	0,15
Chloropicrin	0,55
Bromomethyl	15
Methallylchloride	20
Hydrochloric acid	40
Nitric acid	25
Flammable substances	200
Flammable liquids located in good and raw material warehouses and bases	2 500
Flammable liquids used in technological process or transported through the main pipeline	200
Oxidizing agents	200
Explosive agents	25
Toxic substances	200
Highly toxic substances	20
Substances posing a threat to the surrounding natural environment	200

## Chapter 6 HYGIENE AND OCCUPATIONAL PHYSIOLOGY

### 6.1. Main ideas of harmful and hazardous factors of production environment and labor process

Labor activity of working population takes place in the conditions of production environment and labor process, which, in case of failure to follow technical and hygienic requirements, can cause negative impact on human performance and health. Human labor activity itself is aimed at modification and adaptation of natural items to satisfy his/her vital requirements. Labor assumes the availability of three constituent elements – labor activity itself, subject of labor and means of labor.

The world practice has showed that any production activity is potentially dangerous and it is not possible to achieve the absolute safety. This postulate has a comprehensive and all-encompassing nature, since it determines that actions of humans and surrounding living environment and, above all, technical facilities and technologies, besides positive properties and results, have the property of hazard and are capable of generating negative factors. Manufacturing activity has a special hazard, since it produces the highest levels of negative factors of the production environment and labor process [3, 37-40].

Production environment negative factors are also typically called hazardous and harmful production factors. The impact of a hazardous production factor typically leads to injury or death. The impact of a harmful production factor comes with deterioration of health of a worker and development of a certain disease. There are quantitative and qualitative relationships between hazardous and harmful production factors, when, at high levels of harmful production factors, they can become hazardous and, vice versa, high levels of hazardous factors can come with harmful action. Such kind of division of negative production factors into hazardous and harmful

production factors is quite relative and is determined by the predominant nature of their emergence in operating conditions.

Harmful and hazardous factors of the occupational environment can be of natural and man-made nature, i.e. created by human in the process of labor activity (physical, chemical, biological) and psychophysiological (Figure No. 10-14).

*Physical factors:*

- natural: all climatic indicators: air temperature, humidity, wind velocity, atmospheric pressure, solar radiation;
- man-made: dustiness of air of a working site, vibrations (general and local); acoustic vibrations (infrasound, noise, ultrasound, static electricity); electromagnetic fields and radiations; electric current; moving vehicles, mechanisms, materials, products, elements of breaking down structures and others, height, falling objects, sharp fragments; high or low temperature of equipment and material surfaces; mass destruction weapon.

*Chemical factors:*

- natural: chemical substances entering human organism with air, water, food. These chemical substances include amino acids, vitamins, proteins, fats, carbohydrates, macro and micro elements;
- man-made: gas contamination of a working site; dustiness of a working site; contact of poisons with skin coverings and mucous coats; entry of poisons into gastro-intestinal tract from various works and transport or after being subjected to chemical weapon.

*Biological factors:*

- natural: microorganisms: bacteria, viruses, funguses;
- man-made: biological plant-protecting agents, emissions of food industry enterprises, farms, enterprises on production of proteins, serums, vaccines, lubricating-cooling fluids, biological weapon.

*Psychophysiological factors:* by nature of their impact, they are divided into physical overworks (they include static and dynamic overworks) and nervous and psychological overworks (mental strain, strain of sensory receptors, monotony of labor and emotional stresses).

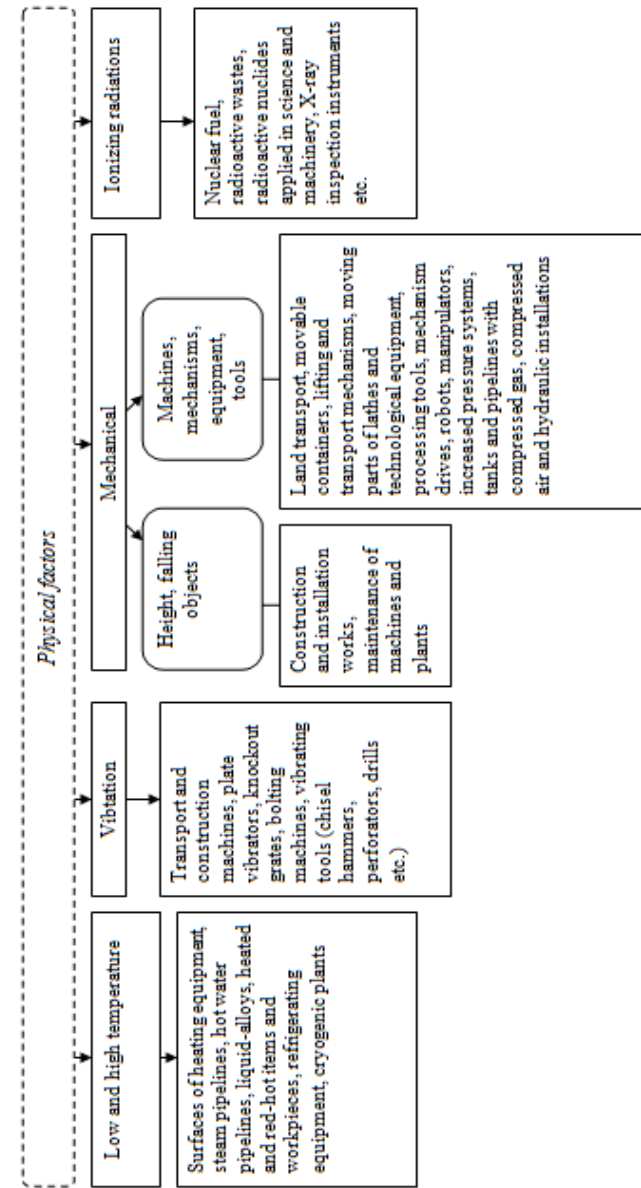


Figure No. 10. Hazardous, harmful factors of the occupational environment and sources of their origin.

Figure No. 11. Hazardous, harmful factors of the occupational environment and sources of their origin.

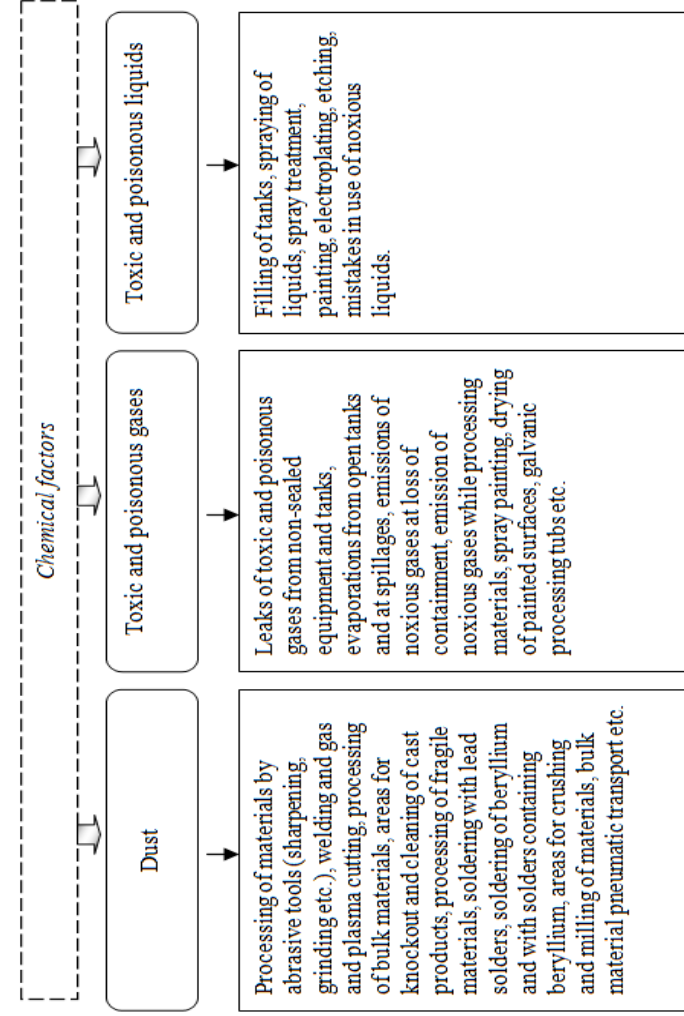
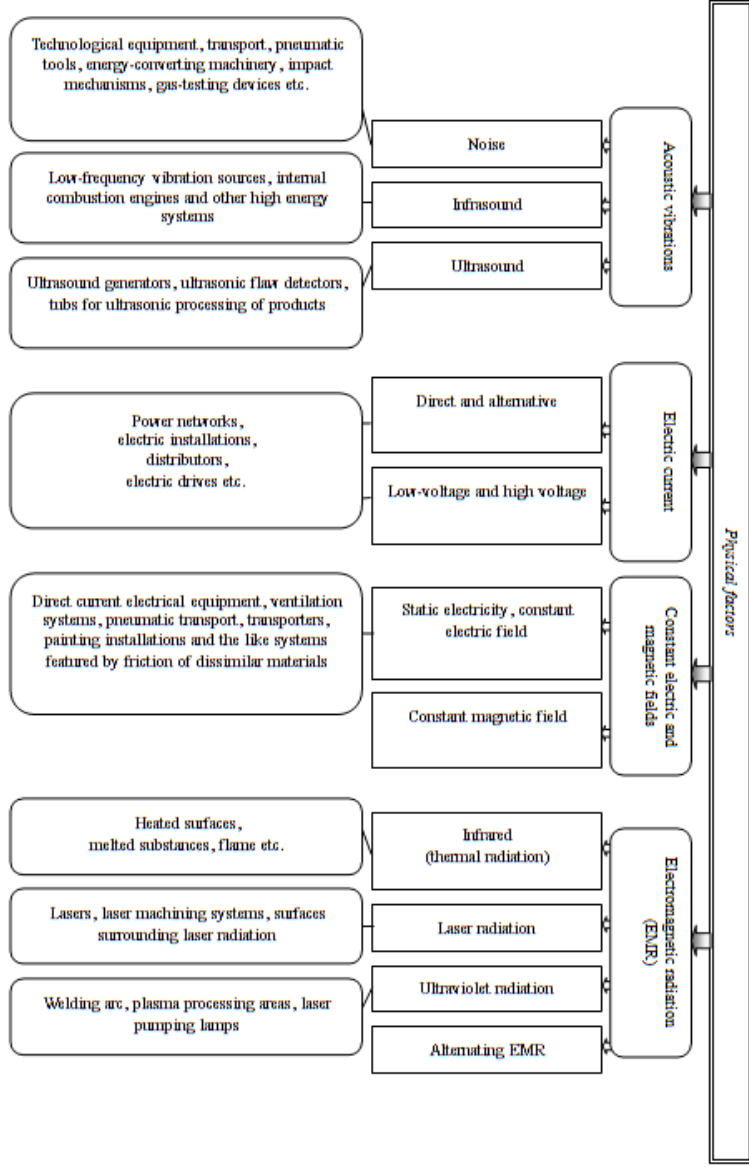
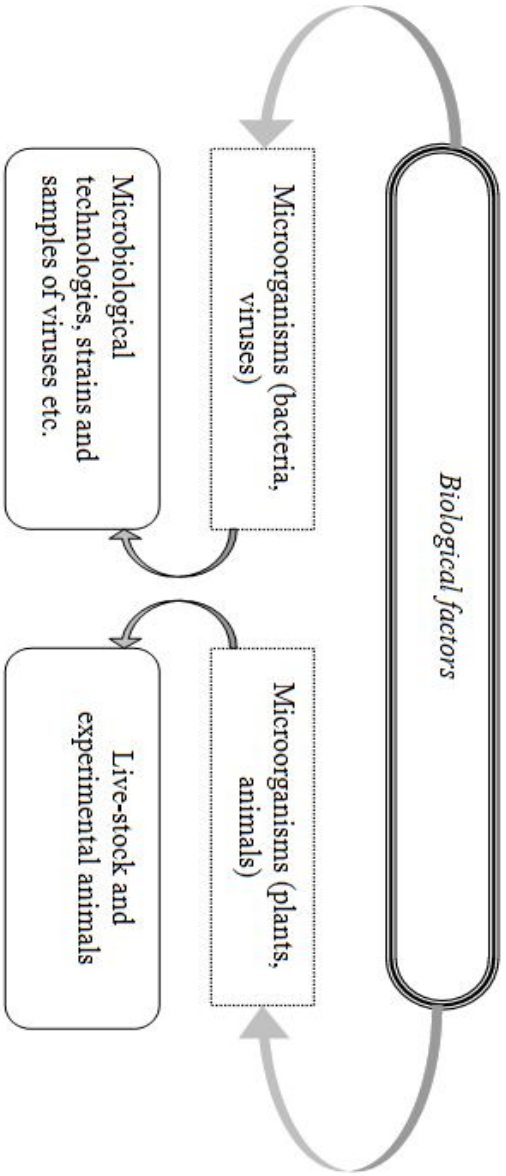
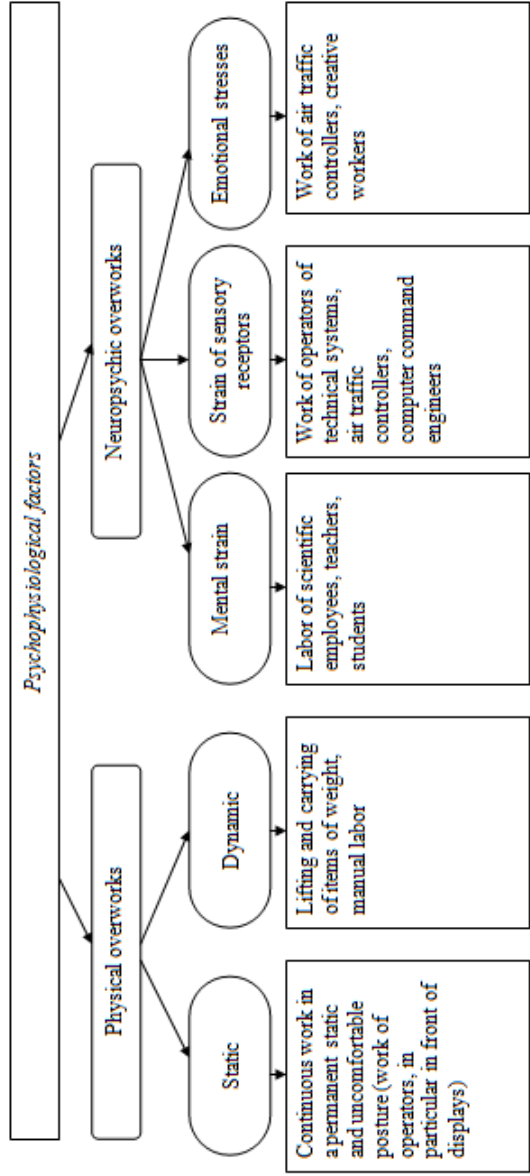


Figure No. 12. Hazardous, harmful factors of the occupational environment and sources of their origin.



*Figure No. 13.* Hazardous, harmful factors of the occupational environment and sources of their origin,



*Figure No. 14.* Hazardous and harmful factors of labor process.

Mechanical movements and actions of technological equipment also pose a serious threat to the health of working cohorts. The wide diversity of types of mechanical movement – rotary, reciprocating and transverse – occur as a result of operation of the most diverse mechanisms and machines moving on the assembly line of products and workpieces. The typical sources of mechanical injuries are lifting and transporting equipment and machinery, which are available in a great number and variety. The lifting and transporting machines include a large number of various mechanisms having a complex of mechanical hazards. A vast number of production and household equipment and apparatus (boring, drilling, turning and milling machines; band and ring saws; mechanical presses; mechanical, hydraulic and pneumatic cutters, drives and pipe benders and etc.) can have a mechanical cutting, impacting, shearing and bending effect.

Manual (screws, knives, chisels, hammers, planers etc.) and power-driven (drills, perforators, planers, saws etc.), bench, carpenter and assembly tools are the source of mechanical injuries and, as a rule, these types of tools cause damage to fingers and hands located in a material processing area, as well as to eyes by fragments, chips and dust flying off from the area of processing. Corrosion of metals is a cause of loss of structure strength and contributes to its unexpected collapse. The most various structures and tanks operating under high pressure, in case of their collapse, cause damaging mechanical, chemical and temperature impacts on human. Falling down on slippery floor and from height, in case of failure to observe safety procedures, causes severe bodily injuries.

The World Health Organization (WHO) set out the nomenclature of hazards, which is expressed in alphabet order:

- ✓ alcohol, abnormal air temperature, abnormal air humidity, abnormal air velocity, abnormal barometric pressure, abnormal lighting, abnormal air ionization;
- ✓ vacuum, explosions, explosive materials, vibration, water, rotating machinery parts, height;
- ✓ gases, herbicides, hypodynamia, hypokinesia, depth, ice-covered ground, hot surfaces;

- ✓ moving objects, dynamic overloads, rain, smoke;
- ✓ caustic substances;
- ✓ diseases, enclosed volume;
- ✓ excessive pressure in vessels, infrasound, infrared radiation, sparks;
- ✓ oscillatory motion, kinetic energy, corrosion;
- ✓ laser radiation, leaf fall;
- ✓ magnetic fields, medicaments, meteorites, microorganisms, lightning, monotony;
- ✓ flood, limescale, alteration of gas content of air, insufficient strength, wrong actions of personnel, uneven surfaces;
- ✓ flammable substances, fire, weapon, sharp objects (piercing, cutting), intoxication, action errors of people, cooled surfaces;
- ✓ falling (without cause determined), steam, overload of machinery and mechanisms, stress of analyzers, pesticides, high intensity of light, fire accidents, psychological incompatibility, luminous flux pulsation, dust;
- ✓ working posture, radiation, resonance;
- ✓ sensory deprivation, slippery surface, movement speed, snowfall, solar activity, sun (sun stroke), somnolentia, static loads, static electricity;
- ✓ typhoons, high frequency current, fog;
- ✓ shock wave, ultrasound, ultraviolet radiation, mental stress, hurricane, acceleration, tiredness;
- ✓ noise;
- ✓ electric arc, electric current, electric field, electromagnetic field, emotional overload, emotional stress;
- ✓ noxious substance.

Type and conditions of labor activity play an exclusively important role not only in producing material product, but in preservation of health both of an individual and population as a whole. Labor activity can be divided into *physical* and *mental labor*. *Physical labor* is primarily characterized by increased muscular load on supporting-motor apparatus and its functional systems: cardiovascular, neuromuscular and respiratory. *Mental labor* is associated with reception and processing of information and requires



stressing of attention, memory, activation of thinking processes, and is featured by increased emotional stress (Figure No. 15).

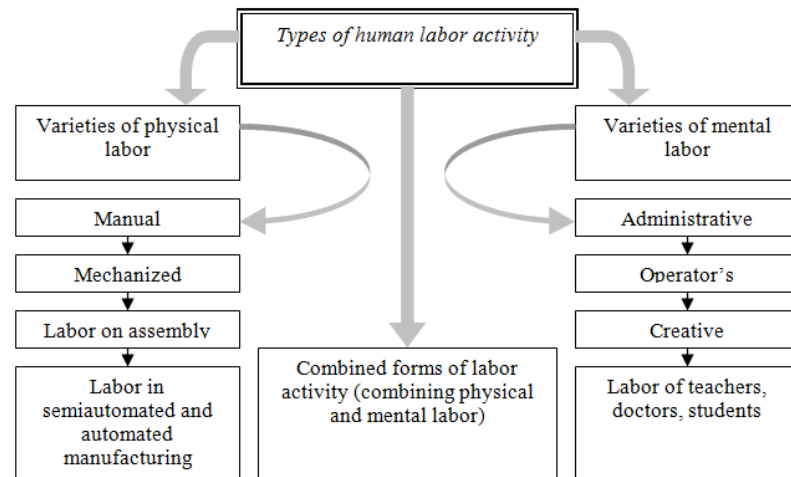


Figure No. 15. Varieties of physical and mental labor.

Solely physical labor is rare in modern conditions of labor activity. The widely recognized classification of labor activity outlines the forms of labor requiring significant muscular activity, mechanized form of labor, labor on assembly line, labor in semiautomated and automated industry. The mental labor is divided into the following forms of labor: administrative, operator's, creative, labor of teachers, doctors, students. Combined forms of labor, requiring both physical and mental labor, are frequent in modern conditions.

In the complex hierarchic system of preservation of life and health of workers in the process of labor activity, including legal, social and economic, organizational and technical, sanitary-hygienic, medical and preventive and other measures, occupational medicine plays an important role.

Occupational medicine, as a branch of preventive medicine, formed at the confluence of occupational hygiene and physiology, industrial ecology and toxicology, clinical disciplines (occupational pathology), epidemiology, public healthcare etc.

**Occupational medicine** – is an integrated branch of preventive medicine, which aim is to control the health status of workers, and the subject-matter is scientific justification and practical introduction of means and methods of its preservation and promotion.

According to WHO, experts of occupational medicine are persons properly accredited to work in any profession associated with occupational medicine and providing services on occupational medicine according to relevant regulations. Occupational medicine experts include all, who, within their professional competence, solve problems of occupational medicine and protection, provide occupational medicine services or are engaged in practicing occupational medicine. These can include occupational medicine doctors, nurses, occupational protection and medicine inspectors, occupational hygienists, occupational physiologists and experts dealing with ergonomics, prevention of accidents and improvement of occupational environment, as well as investigations on the issue of occupational medicine and protection.

In modern market conditions, as it is known, profit earning is a dominant rule. At the same time, the problems of creating safe labor conditions, preservation and promotion of workers' health are taking back seat. The multiple established private enterprises, including small and medium size, were headed by initiative, but frequently untrained in the field of occupational medicine, managers. All that led to the increase of not only occupational injuries and accidents, but to the increase of occupationally induced morbidity.

The common causes of occupational traumatism, occupational diseases, and occupationally and environmentally induced diseases are the following:

- physical and moral wear of technological equipment;
- employers' failure to execute necessary organizational and technical and sanitary-hygienic measures on ensuring safe working environment;

- absence of necessary supervision and control over safe conduct of operations on the part of relevant units;
- low quality of conduct of medical examinations of the working cohort;
- poor organization of activities on training and checking of workers' knowledge of occupational safety rules, failure to observe the occupational safety procedures etc.

The modern production process is featured by application at one enterprise of various technological processes that are complicated in terms of their physical and chemical basis. The characteristic feature of the present-day production process is a rapid change of technologies, update of equipment, introduction of new processes and materials, which are frequently not sufficiently studied from the hygienic and toxicological point of view. The majority of enterprises widely apply highly toxic chemical substances, and the technological process is associated with the exposure of a worker to significant levels of vibration, noise, electromagnetic fields, ultrasound and infrasound, mechanical factor, negative microclimatic conditions, dust and gas contamination, as well as hard work.

The algorithm of safety management methods at production facilities and creation of healthy occupational conditions is shown on Figure No. 16.

According to the requirements of the Labor Legislation of RK, each employer performing production activity with the number of workers exceeding 50 people shall arrange a work safety service or introduce the position of a work safety expert having relevant qualification and work experience in this field. The work safety service carries out its activity in cooperation with other subdivisions of an enterprise.

Primary objectives of the work safety service:

- organization of work to ensure that workers observe the labor protection requirements;
- control over the observance by workers of laws and other regulatory legal acts on labor protection, collective labor agreement, labor protection agreement, other local regulatory legal acts of an organization;

- organization of the activity on prevention of occupational traumatism, occupational diseases and diseases caused by workplace factors, as well as actions on improvement of labor environment;
- informing and consulting workers of an enterprise (organization), including its employer, on the issues of occupational safety;
- study and distribution of advanced experience on occupational safety, propaganda of occupational safety issues.

The coming chapters of this guide provide hygienic characteristics of main hazardous workplace factors and data on their biological effect on organism, on hygienic standardization and preventive measures.

Algorithm for management of the occupational safety system in production process

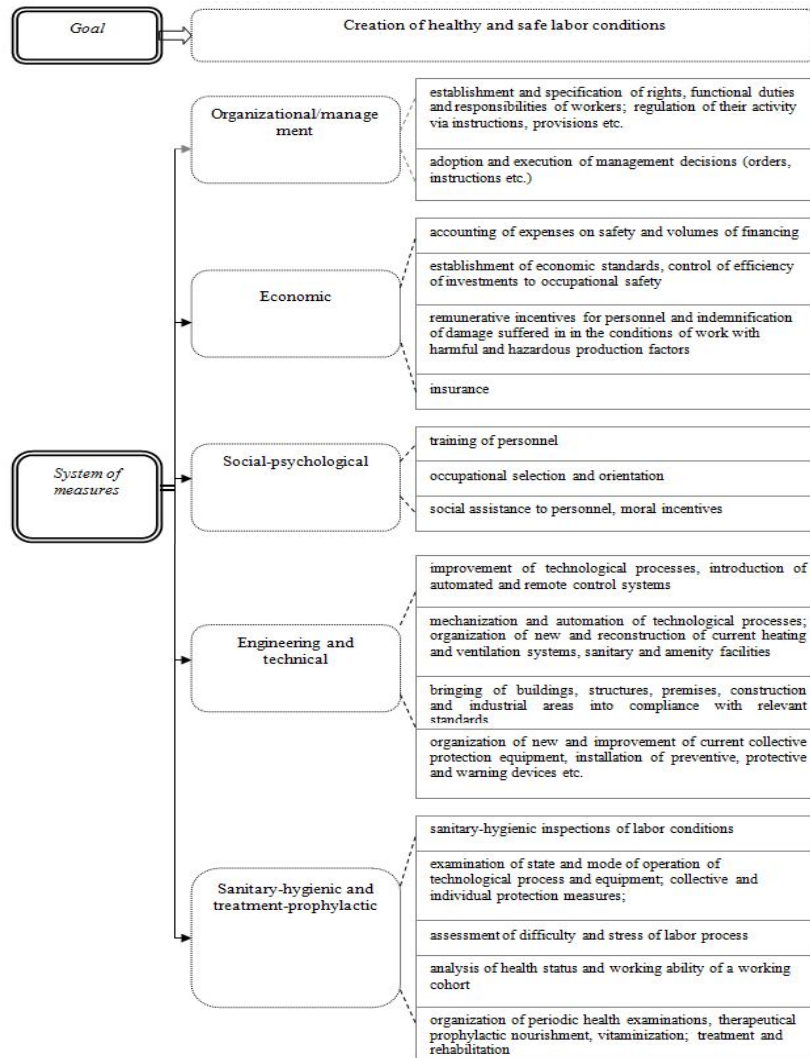


Figure No. 16

## 6.2. Working environment factors

### 6.2.1. Microclimate

Microclimate is the most important factor of the surrounding (working) environment the working ability and health status of the working population depend on. The working microclimate is characterized by such parameters as the level of temperature and humidity of air, its velocity and intensity of thermal radiation primarily in infrared and partially in ultraviolet range of spectrum of electromagnetic radiations.

The air temperature, determining meteorological conditions of the working environment, plays an important role in creation of a comfortable working environment of industrial workers. In many industries – metallurgic (blast-furnace, converter, open-hearth and rolling-mill shops), mechanical-engineering (cast, forge, heat-treatment shops), as well as thermal power stations, textile, rubber, garment, glass and food manufactures, production of construction materials (brick, concrete), the labor of workers is associated with the influence of a negative heating climate. At the same time, a number of productions, on the contrary, are characterized by low air temperatures in workplaces – the labor of workers dealing with elevators, in storage rooms, in certain workshops of shipbuilding facilities, dairy-and-meat industry.

Open-air activities (construction, timber logging, fishing industry, extraction of oil and gas, geologic exploration etc.) in autumn, winter, spring and summer periods frequently take place in extremely negative climatic conditions. Now and then the difference between the lowest and hottest air temperature reaches quite high values (range of fluctuations is from 50<sup>0</sup>C up to 80<sup>0</sup>C).

Therefore, there is an undoubted relevance in hygienic assessment of main consistent patterns of microclimate formation, adaptation of organism to heating and cooling climate, justification of relevant standards, development of comprehensive preventive measures on ensuring a comfortable working environment.

**Characterization of microclimate.** Environmental temperature, air velocity and humidity are the parameters of microclimate, under which a human performs works and on which the heat exchange between human organism and environment is dependent.

Environmental temperature and ambient air velocity depend of a wide variety of parameters determined by time of year and entire complex of other hydrometeorological factors that form a region's climate. Circulation of air in working premises is driven by convective flows due to the differential heating of air masses by heat radiation sources.

Humidity of air depends on its content of water vapors and is divided into *absolute humidity* (expressed as partial pressure of water vapors (Pa) or in weight units in a specific volume of air [g/m<sup>3</sup>]); *maximum humidity* (expressed as the amount of moisture upon full saturation of air at a given temperature); *relative humidity* (expressed as the ratio of absolute humidity to maximum humidity in percentage). *Saturation deficit* – is a difference between maximum and absolute air humidity.

*Comfortable (neutral) microclimate* is characterized by comfortable warmth sense modality, and the temperature balance in organism is ensured without stress of thermal regulation processes.

*Heating microclimate* is characterized by the fact that microclimate parameters at workplaces are significantly lower than the average values of the comfort zone thresholds.

*Cooling microclimate* is characterized by air temperatures that are significantly lower than the comfort zone lower thresholds.

*Thermal regulation* – is an interaction of heat generation and heat emission processes regulated at the nervous-endocrinous level.

*Heat generation* – is a heat produced by organism as a result of reductive-oxidative responds in the process of burning of proteins, fats and carbohydrates.

*Heat emission* – is a transfer of the temperature, released during life activities, from organism to environment.

Heat emission is driven by radiant heat transfer (radiation of heat by human body in relation to surrounding surfaces having a

lowing temperature); convection (emission of heat from human body to less heated air layers inflowing to him/her); heat conduction (emission of heat to objects directly contacting with body surface); evaporation of water from skin surface and respiratory channels. In meteorological comfort conditions, the heat emission by radiation makes an average of 50-65%, by evaporation of water (sweat) – 20-25%, by convection – 15-30% of the total losses of heat by organism.

***Effect of heating and cooling microclimate on organism.***

Being a self-regulating system, human organism, using the entire cascade of physiological and biochemical reactions, maintains the constancy of body temperature via strengthening or weakening of heat production and heat emission mechanisms. The dynamic relation of heat generation and heat emission processes is regulated by thermoregulatory centers and cortex of cerebrum. At the same time, the combination of physiological and biochemical processes induced by the activity of central nervous system and aimed at maintenance of temperature homeostasis reflects the key idea of thermal regulation process.

Thermal regulation is one of the most important physiological mechanisms allowing to maintain a relative dynamic constancy of organism functions under various meteorological conditions and various heaviness of work being performed. The thermal regulation system includes a heat center located in hypothalamus, thermosensory nerve cells in various segments of central nervous system, thermoreceptors of internals, mucous coats and skin having corresponding nervous conduction tracts, descending tracts and effector organs in the form of cutaneous vessels, endocrine and perspiratory glands and skeletal muscles.

Among physiological mechanisms allowing to establish an adequate ratio of chemical and physical thermal regulation, sympathetic nervous system plays an important role. Sympathetic nerve fibers transfer impulses from central nervous system to muscles and liver engaged in the process of chemical thermal regulation. Nature and intensity of heat transfer from human body, where a significant importance is assigned to the vascular response to

irritation caused by a temperature factor, largely depends on the activity of sympathetic nervous system.

Under the impact of a heating climate on organism, the thermal regulation mechanism causes the increase of thermal emission through the blood circulatory system and by hyperhidrosis. The function of the blood circulatory system is to increase heart rate and minute cardiac output, what leads to the increase of bloodstream through skin as a result of engorgement of cutaneous vessels and capillary tubes. The mentioned mechanism contributes to the increase of thermal conductivity of tissues and supply of heat to the environment.

Under the impact of a cooling climate on organism, the thermal regulation mechanisms are aimed at reduction of heat emission and increase of the amount of heat produced by the organism. Reduction of heat emission occurs as a result of constriction (vasospasm) of vessels of superficial tissues and reduction of their temperature. Increase in heat generation is primarily driven by the increase of muscle tone and reflectory shivering of skeletal muscles.

The complex process of physical chemical thermal regulation in working conditions is characterized by a variety of changes and interaction of physiological functions of an organism. Upon overheating and excessive heat loss, substantial changes occur in behavioral and physiological responses, including endocrine system. Hypothermia typically comes with the increased secretion of adrenaline that stimulates cellular metabolism and reduces heat emission. Table No. 12 shows the classification of human organism thermal states built on the basis of data on the nature of response of adaptive mechanisms of the thermal regulation system in the conditions of thermal equilibrium, overheating or cooling.

*Optimal microclimate* is characterized by the combination of parameters determining the preservation of a normal functional state of organism without stress of the thermal regulation response. It arises sensation of a thermal comfort and conditions for preservation of a high level of working ability. *Permissible microclimate* is a combination of parameters causing changes of the functional state of

organism and stress of the thermal regulation response that do not go beyond the thresholds of physiological adaptive capabilities.

**Hygienic standardization of microclimate.** Hygienic standardization of working microclimate parameters is specified by sanitary and hygienic standards: SanPiN “Sanitary requirements to the microclimate of working spaces” No. 355 dated 14.07.2005, Ministry of Health of the Republic of Kazakhstan; SN “Sanitary norms of ultraviolet radiation in working spaces” No. 1.02.025-94; HN “Hygienic norms of intensity of infrared radiation from heated surfaces of equipment and fences in machine and boiler rooms and other shipbuilding production premises” No. 1.02.026-94.

Optimal and permissible microclimate parameters are standardized – temperature, relative humidity and air velocity. Values of microclimate parameters are set depending on the ability of human organism to acclimatize at different periods of year and categories of works based on energy expenditure levels (Table No. 13).

Table No. 12. Indicators of organism thermal state.

Indicator	Level of physiological indicators in the conditions of						
	overheating		thermal equilibrium	cooling			
Thermal sensations	very hot	hot	warm	comfortably cold	moderately cold	cold	Very cold
Rectal temperature, °C	39,5-38,5	38,4-37,7	37,6	37,0-37,4	36,7	36,6-35,5	Below 35,5
Oral temperature, °C	40,0-38,4	38,3-37,5	37,4	36,6-37,0	36,0	35,9-34,5	Below 34,5
Weighted average skin temperature, °C	40,5-38,0	38,5-36,1	36,0	32,5-33,5	30,0	29,9-27,0	Below 27,0
Average body temperature, °C	39,5-38,5	38,4-37,6	37,5	36,0-36,7	34,5	34,4-31,7	Below 31,7
Difference of temperatures of soma and extremities (chest-foot), °C	-2,5+1,5	-1,5+0	0	+4,0+2,0	+6,0	+6,0+10,0	Above 10,0
Internal temperature gradient, °C	+1,0+0	0+1,6	-1,6	-4,5+3,5	+6,7	-6,7+8,5	>8,5
Thermal insulation of superficial tissues, clo	<0,05	0,05-0,10	0,10	0,35-0,25	0,50	0,50-0,60	>0,60
Body weight loss, g/h	1200-650	650-250	250	40-60	80	80-100	-
Pulse frequency, beats per minute	160-120	120-90	90	60-80	60	60-50	-
Organism heat production, W/m <sup>2</sup>	80-65	65-45	45	60-45	70	70-140	Increase up to 350 with subsequent reduction
Heat emission by water evaporation, W/m <sup>2</sup>	185-150	150-60	60	10-20	25	25-35	-
Change of organism heat content, kJ/m <sup>2</sup>	+420+250	+250+150	+150	-50+50	-250	-250+60	>-600

Warm period of year	Cold period of year	Period of year	Work categories	Air temperature, °C				Relative humidity, %		Air velocity, m/s		
				optimal		At workplaces		permmissible		permmissible		
				Permanent	Non-permanent	Permanent	Non-permanent	At workplaces, permanent and non-permanent	optimal, no more than	At workplaces, permanent and non-permanent	permmissible	
		Light – 1a		22-24	25	26	21	18	40-60	75	0,1	no more than 0,1
		Light – 1b		21-23	24	25	20	17	40-60	75	0,1	no more than 0,2
		Average heaviness – IIa		18-20	23	24	17	15	40-60	75	0,2	no more than 0,3
		Average heaviness – IIb		17-19	21	23	15	13	40-60	75	0,2	no more than 0,4
		Heavy - III		16-18	19	20	13	12	40-60	75	0,3	no more than 0,5
		Light – 1a		23-25	28	30	22	20	40-60	55 at 28°C	0,1	0,1-0,2
		Light – 1b		22-24	28	30	21	19	40-60	60 at 27°C	0,2	0,1-0,3
		Average heaviness – IIa		21-23	27	29	18	17	40-60	65 at 26°C	0,3	0,2-0,4
		Average heaviness – IIb		20-22	27	29	16	15	40-60	70 at 25°C	0,3	0,2-0,5
		Heavy - III		18-20	26	28	15	13	40-60	75 at 24°C and lower	0,4	0,2-0,6

**Table No. 13.** Standardized values of temperature, relative humidity and air velocity in working areas of manufacturing premises (SanPiN No. 355 dated 14.07.2005; GOST 12.1.005-88, Labor safety standards system, extractions).

Despite the adaptive processes ensuring the increase of human organism resistance to negative meteorological environmental conditions, the long-term and intensive impact of heat and cold can lead to deterioration of its compensatory-defensive mechanisms and development of pathological states. In order to prevent negative impact of a microclimate on workers' organisms, the duration of presence of workers at workplaces in the conditions of a heating and cooling climate is subject to regulation. At the same time, the average monthly temperature for a standard work pattern, when people are present at workplaces, shall not go beyond the limits of permissible values for corresponding categories of works (Table No. 14, 15).

**Table No. 14.** Duration of presence of workers at workplaces at the air temperature level lower than the permissible values (SanPiN No. 355 dated 14.07.2005; GOST 12.1.005-88, Labor safety standards system, extractions).

Workplace air temperature, °C	Duration of presence, according to work categories, no more than, h				
	la	lb	IIa	IIb	III
1	2	3	4	5	6
6	–	–	–	–	1
7	–	–	–	–	2
1	2	3	4	5	6
8	–	–	–	1	3
9	–	–	–	2	4
10	–	–	1	3	5
11	–	–	2	4	6
12	–	1	3	5	7
13	1	2	4	6	8
14	2	3	5	7	–
15	3	4	6	8	–
16	4	5	7	–	–
17	5	6	8	–	–
18	6	7	–	–	–
19	7	8	–	–	–
20	8	–	–	–	–

**Table No. 15.** Duration of presence of workers at workplaces at the air temperature level above the permissible levels (SanPiN No. 355 dated 14.07.2005; GOST 12.1.005-88, Labor safety standards system, extractions).

Workplace air temperature, °C	Duration of presence, according to work categories, no more than, h		
	Ia-Ib	IIa-IIb	III
32,5	1	–	–
32,0	2	–	–
31,5	2,5	1	–
31,0	3	2	–
30,5	4	2,5	1
30,0	5	3	2
29,5	5,5	4	2,5
29,0	6	5	3
28,5	7	5,5	4
28,0	8	6	5
27,5	–	7	5,5
27,0	–	8	6
26,5	–	–	7
26,0	–	–	8

In order to assess the combined impact of microclimate parameters and develop measures on protection of workers against potential overheating, the integrated indicator of environment thermal load (ETL index) is applied in the practice of sanitary-hygienic control. ETL index is an empirical measure characterizing the combined impact on human organism, humidity, air velocity and thermal exposure (Table No. 16).

**Table No. 16.** Recommended values of ETL index for prevention of heating (SanPiN No. 355 dated 14.07.2005; GOST 12.1.005-88, Labor safety standards system, extractions).

Work categories according to energy expenditure levels	Integrated index values, °C
Ia (до 120 kcal /hour)	22,2-26,4
Ib (121-150 kcal /hour)	21,5-25,8
IIa (151-200 kcal /hour)	20,5-25,1
IIb (201-250 kcal /hour)	19,5-23,9
III (>250 kcal /hour)	18,0-21,8

**Preventive measures.** Thermal equilibrium is ensured by means of regulation of microclimate parameters in a room – temperature, relative humidity and air velocity. Maintenance of the mentioned parameters at the level of optimal values ensures comfortable climatic conditions for a human, and at the level of permissible levels – maximum permissible conditions, in which the organism thermal regulation system ensures a thermal equilibrium and does not allow overheating or hypothermia of organism.

Application of systems of air ventilation, aerating, heating and conditioning ensures the required microclimate parameters and air environment content.

Efficiently operating ventilation (*ventilation* – is an organized regulated air exchange ensuring removal of waste air and supply of fresh air instead in a room), air conditioning (*conditioning* – is an artificial semiautomatic air treatment for the purposes of maintaining optimal microclimatic conditions irrespective of nature of a technological process and external environment conditions), aeration (*aeration* – is an organized natural ventilation of rooms through fan-lights, ventilating windows and windows) and heating (*heating* – is a system of providing an optimal air temperature in a room in cold periods of year, which can be implemented as water, steam and electric heating) all contribute to the improvement of human well-being and performance incoordination.



The industrial production process applies a set of measures aimed at prevention of the negative impact of a heating microclimate, which can be divided as follows:

- measures aimed at limitation of heat emission to a workplace or ensuring the possibility to work outside the heating microclimate zone;
- measures aimed at reduction of air temperature and intensity of infrared radiation at a workplace;
- measures ensuring normalization of workers' thermal state in the conditions of a heating microclimate and contributing to restoration of physiological indicators of the organism.

The complex of engineering and technical and sanitary-hygienic measures aimed at reduction of the impact of a heating microclimate on the organisms of workers of industrial enterprises includes the following: prevention of the presence of workers in unfavorable zones (mechanization and automation of remote control production processes); limitation of thermal and moisture emissions from technological sources (workplace screening); use of individual protection equipment (overalls, footwear, helmets, gloves, glasses, protective covers); normalization of physiological functions of a worker's organism (rational schedule of work and rest, water consumption schedule ensuring the restoration of macro and micro elements, vitamins, water procedures etc.).

In the conditions of the impact on a cooling microclimate on workers, preventive measures shall be directed towards the regulation of works, improvement of sanitary and household support, application of efficient methods of heating of workers against cooling. The complex of preventive measures includes the following:

- measures aimed at creation of optimal and permissible microclimate conditions (heating insulation of rooms, organization of air-lock corridors and air and heat curtains at doors, efficiently operating heating supply etc.);
- measures ensuring maintenance of a permissible thermal state of workers in cold periods of year in the open air, in unheated premises and premises with an artificial cooling microclimate

(application of overalls, regulated meal and rest time, premise for drying of overalls and footwear, time protection).

The entire complex of preventive measures in heating and cooling microclimate conditions shall be applied according to the requirements of current regulatory documents.

### 6.2.2. Illumination

It is common knowledge that the person perceives the greatest amount of information about the environment through a visual analyzer. In this regard, organization of optimal natural and artificial lighting in the workplaces, living quarters and public buildings is important for ensuring the normal human life and performance.

One of the main issues of protection and improvement of working conditions is organization of optimal lighting in industrial premises and workplaces. Three types of lighting: natural, artificial and mixed lighting are used for illumination of production premises.

Optimally organized lighting is not only one of the indicators of high level of work culture, but also an integral part of ergonomics and production aesthetics. Correctly organized lighting system corresponding to the requirements of regulatory documents increases labor productivity, reduces production faults, provides psychological comfort, and helps to reduce visual and general fatigue.

***The characteristic of illumination.*** Hygienic criteria for industrial lighting serving the needs of the body's vital activity, must meet the following requirements:

1. Provision of adequate lighting optimal for working efficiency and well-being;
2. Spectrum of light created by artificial sources of lighting should be close to the natural lighting;
3. Provision of uniform illumination and normal brightness, absence of glares and shadow;

4. The level of illumination should correspond to the hygienic standards, which take into account the conditions of visual work.

The central section of the optical range, 400 - 760 nm in length, falls on visible radiation perceived by the nervous tunic of the visual analyzer.

*Spectral sensitivity of the eye* is the property of the eye associated with its sensitivity that estimates differently the same radiant power of different wavelengths of the visible spectrum.

*Luminous Flux (F)* is the power of radiant energy estimated by the light perception; unit of measurement - lumen (lm); 1 lumen is equal to the amount of light energy - 1 J passing through a unit area of 1 m<sup>2</sup>.

*The luminous intensity (i)* is the spatial density of the emitted flux determined by the ratio of the light flux to the degree of the solid angle in which it is propagated and determined, the unit of measurement is candela (cd).

*Illumination (E)* is defined as the luminous flux per unit area of the illuminated surface; unit of measurement - lux (lx); 1 lx - surface illumination in m<sup>2</sup> on which the luminous flux in 1 lm falls.

*Brightness (B)* is the level of light perception, i.e. the value directly perceived by our eye; measured in cd/m<sup>2</sup> or in nits (nt).

During execution of certain types of work activities, quantitative and qualitative characteristics of workplace illumination play an important role in the adequate functioning of the visual organ. Figure 17 shows the most important visual functions that depend on lighting.

Insufficient levels of natural and artificial illumination, frequent and sharp lighting change within eyesight, a spectral composition that does not correspond to natural light, pulsations of the luminous flux lead to eye strain and cause fatigue of the photoperceptive and ocular motor system of the eyes, resulting in the abnormal changes in composite visual organs in the form of asthenopia, occupational myopia and nystagmus.

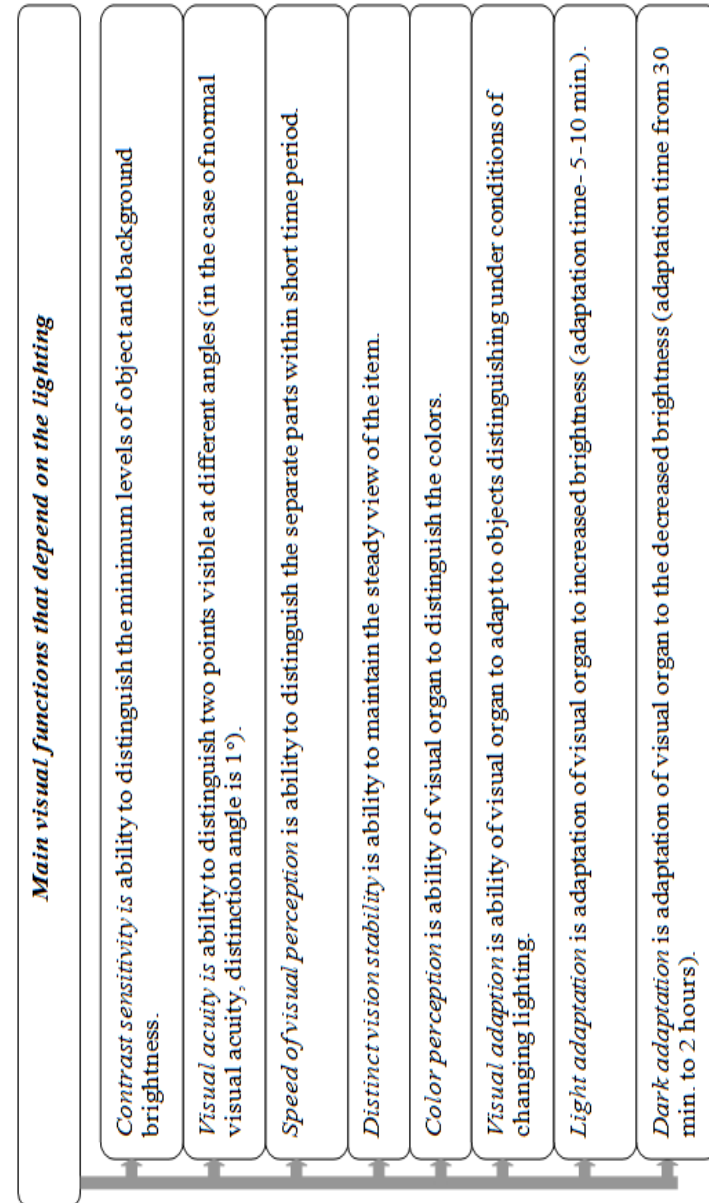


Figure No. 17

**Standards of natural and artificial lighting.** The illumination created by natural daylight varies in an extremely wide range due to the time of the day, year season, availability of clouds or precipitation, and the geographical location. In this regard, the natural lighting of premises cannot be characterized by an absolute amount of illumination. Therefore, the main indicator of illumination standard is daylight factor (DF).

DF is the ratio of the light at the workplace to the level of outside light. DF is expressed in percentage terms and determined according to the following formula:

$$DF = \frac{E_{вн}}{E_{нар}}$$

where  $E_{вн}$  и  $E_{нар}$  is the natural light inside and outside of the building accordingly.

Windows, light apertures and lamps on the roof serve to create natural illumination in the buildings. Natural lighting can be lateral (through windows), overhead (through light apertures and lamps on the roof) or combined. The illumination standards and DF values under natural and combined lighting are given in the corresponding SNiP 23-05-95 "Natural and artificial lighting". All the necessary formulas for calculation of natural illumination and values of the factors are also listed (Table No. 17).

**Table No. 17.** Standardized values of DF in production premises (SNiP P-4-79)

Work category	Characteristics of visual work		Natural lighting	
	Types of work by accuracy level	The minimum size of distinction object, mm	In the case of overhead or overhead and lateral illumination	In the case of lateral illumination
I	Pinpoint accuracy	Less than 0,15	10	3,5
II	Exceptional accuracy	From 0,15 to 0,3	7	2,5
III	High accuracy	From 0,3 to 0,5	5	2
IV	Mean accuracy	From 0,5 to 1,0	4	1,5
V	Low accuracy	From 1,0 to 5,0	3	1
VI	Rough (very low accuracy)	More than 5	2	0,5
VII	Work with luminescent material and items in hot shops	More than 0,5	3	1
VIIIa			3	1
VIIIб			1	0,3
VIIIв			0,7	0,2
VIIIr			0,1	0,1

In the case of unilateral side lighting, the minimum value of DF ( $E_{min}$ ) shall be standardized at a point of 1 m from the wall farthest from the light apertures. In the case of bilateral side lighting, the  $E_{min}$  is standardized at the midpoint of the premise. In addition, light climate and location of the production facility shall be taken

into account. In the case of overhead and combined natural illumination (overhead and lateral), the average value of DF ( $E_{cp}$ ) shall be determined and standardized at points located at the intersection of the vertical plane of the typical size of the premise and working plane or floor, according to the following formula:

$$E_{cp} = \frac{E_1 + E_2 + E_3 + E_n}{n}$$

Where  $E_{1,2,3,\dots,E_n}$  is the value of DF at various equally apart points;  $n$  – number of points (not less than 5) in which DF is determined. During determination, the first and last points shall be located at a distance of 1 m from the wall or partitions surface.

The values of DF given in the SNiP P-4-79 are standardized for buildings, located in III belt of light climate; therefore it is necessary to adjust the daylight factor for other climate belts according to the calculations presented in the above regulatory document.

In production premises, where sufficient illumination cannot be achieved through natural lighting due to technology conditions, combined lighting may be used. In the case of combined lighting, the daylight factor should not be lower than the values specified in this standard (SNiP P-4-79). In production premises, during execution of works of I-VII categories, with combined lighting with lateral lighting, as well as during execution of works of I-II categories with combined illumination with overhead and lateral lighting, it is allowed to reduce the values of daylight factor, but not lower than the values indicated in the table No. 17. However, total illumination should be increased through artificial lighting.

There are several systems of artificial lighting - general, local and combined. The system of general lighting provides two ways of placing lamps - uniform and localized; the local lighting system is used only to illuminate the working area. In the case of combined system, local lighting is used to create high levels of brightness at working area, and general lighting is used to ensure uniform illumination of sections of working area. The standards of artificial

illumination should be adopted in accordance with the requirements of SNiP 23-05-95.

The efficient direction of luminous fluxes plays a crucial role in creating good levels of illumination and, as a consequence, favorable working conditions. Uniform illumination of working areas and premises is generally achieved by such arrangement of light-generating devices which eliminates sharp shadows at working areas, as they create uneven distribution of brightness, disrupt the form of objects and cause visual fatigue. In addition, moving shadows contribute to the occurrence of work-related injuries. However, completely diffuse shadowless illumination is undesirable since it will be hard to distinguish the details in such lighting.

The intensity of the illumination of the working area and the surrounding space should be distributed as evenly as possible, since during glance switching from a strongly illuminated surface to a weakly illuminated surface and vice versa the eye must adapt, which causes its fatigue. The eye adaptation depends on the ratio of brightness of the given surfaces or, when the worker moves from one space to another, on the ratio of the brightness of illumination of different spaces. When the worker moves to weakly illuminated premise, generally, adaptation takes 50-60 minutes, and when worker moves to a strongly illuminated premise - 8-10 minutes. Uniform brightness distribution is facilitated by the light color of the ceiling, walls, equipment. Lighting should provide the necessary spectrum of the light for correct color transfer which is created by natural light and artificial light sources with a spectral characteristic close to natural illumination.

*The sources of artificial lighting* are general-purpose incandescent lamps, gas-discharge and fluorescent lamps, high-pressure gas-discharge lamps and a wide variety of lighting fixtures.

Distinctive features of incandescent lamps are their relatively low light output, a short duration of lighting, significant effect of voltage on the lifetime and luminous flux. According to intended use, incandescent lamps are classified into general purpose lamps and special-purpose lamps (signal, transport, metrological, etc.).

Incandescent lamps are widely practised, their bulbs are covered with a reflecting white diffuse layer and a mirror layer. Halogen lamps are becoming more and more widespread in different fields of lighting technology.

The incandescent lamps, being the sources of the light of thermal flux, generate yellow-red rays in their light spectrum, which distorts the color sensation. These lamps are much inferior to gas-discharge light sources in light output and in light transmission, which limits their use in production.

There are low-pressure gas-discharge lamps - high-pressure luminescent and mercury quartz lamps with directional chromaticity of DRL type (mercury arc luminescent), metal-halide lamp with the addition of iodide metals of DRI type (arc mercury with metal iodides), etc. Fluorescent lamps are used in premises with insufficient natural light, where people present permanently as well as to create especially favorable conditions for visual work. Lamps of DRL and DRI types are widely used for lighting of industrial and public premises.

The principle of functioning of fluorescent lamps is based on the use of photoluminescent luminophors actuated by ultraviolet radiation of an electric discharge in mercury vapors at low pressure. The invisible ultraviolet radiation of the plasma (ionized metal vapor) is converted by means of luminophors into the radiations perceived by the eye. There are fluorescent lamps with a discharge in inert gases - mercury-free lamps which have three important advantages: they are non-toxic, functioning at low temperatures and are suitable for luminophores activated by short-wave ultraviolet radiations.

In contrast to incandescent lamp, fluorescent lamps have a number of advantages: high light output, long service life, low cost and simple design, favorable spectrum of radiation. At the same time, fluorescent lamps have the following disadvantages: low power, large tube sizes, difficulty in redistribution and concentration of their light flux in space, connection to the electric network only via control gears.

Gas discharge lamps, having a high light output and improved chromaticity, are generally used for general illumination of

production facilities with insufficient or no natural lighting, for general lighting in a system of combined lighting of public, administrative and other buildings, street lighting.

Creation of high-quality and cost-efficient lighting in production facilities is impossible without the use of rational lighting fixtures. Lighting fixtures (light sources enclosed in the fittings) are designed to redistribute the luminous flux and protect the eyes from excessive brightness of the light source, and fittings used in their design protects the light source from mechanical damage, dust, moisture, provides adequate fastening and electrical connection.

The choice of these or other light fixtures by light distribution depends on the nature of the work performed in the premises, the probability of air dusting, reflection factors of the reflecting surfaces, etc. An important characteristic of the lighting fixture is its efficiency. Lighting fixtures absorb some of the luminous flux emitted by the light source. *The coefficient of efficiency of lighting fixture* is the ratio of the actual luminous flux of the lighting fixture to the luminous flux of the lamp placed in it.

According to the distribution of the luminous flux in space, the light fixtures can be light fixtures of direct, mainly direct, diffused, reflected and predominantly reflected light. According to the dust, water and explosion protection rate, the following light fixtures are distinguished pursuant to the rules of electric plants installation: open light fixtures (the lamp is not separated from the external environment), protected (the lamp is separated from the external environment by a shell allowing free air passage), closed (the shell protects from penetration of coarse dust), dust-proof (the shell does not allow small dust to penetrate the interior of the fixture), waterproof (the body and cartridge resist the moisture and ensure the safety of the insulation of the leading wires) and explosion-proof.

The lighting system is created with the help of appropriate location of light fixtures in the quantity necessary for the work space. When placing the light fixtures, it is necessary to observe a certain distance between the light fixtures, the height of the lamp post above the working area and from the ceiling. An important requirement

when choosing the light fixtures is their service accessibility. The recommended height of the lamp post is 2.5 m when installed on racks along the fences of process area, and not more than 3.5 m when installed on walls and ceilings of the areas of top elevations. Light fixtures with “point” light sources are located on the tops of square, rectangular and triangular fields. In narrow premises, a single-row arrangement can be used. Continuous rows or rows with small discontinuities (luminous lines) have some advantages. The regulatory documents also provide for a number of requirements to placement of street lights.

The standards of lighting and qualitative characteristics of lighting are regulated by SNiP P-4-79, SNiP 23-05-95 standards which provide minimum required illumination of working areas of production premises, based on the conditions of visual work. These standards are of an intersectoral nature and, serve as basis for development of industry standards for various types of production. Depending on the size of the smallest object of distinction, according to the above standards, all visual works are divided into eight categories.

For works of higher categories (I-IV), the illumination standards are set depending on the system of general or combined illumination, and for the works of lower categories (V-VIII), the illumination standards are set only for the general lighting system. Standards and qualitative characteristics of artificial lighting apply to installations with gas-discharge light sources. In cases of using incandescent lamps, the decreased illumination values shall be established.

Depending on the nature of the work, the above regulatory and legal acts provide for both increasing and decreasing of the levels of illumination. The illumination standards are increased by one step, according to the illumination scale, in cases of intense visual work, increased risk of injury, increased sanitary requirements (pharmaceutical and food industry, assembly machinery production; training of students), lack of or insufficient natural light. Illumination standards shall be decreased with short stay of people in the premise

and availability of equipment that does not require constant monitoring.

### 6.2.3. Occupational dust

Currently, the dust prevention, which is the most common unfavorable factor of the occupational environment, seems to be an extremely topical problem facing the occupational medicine and hygienic science. A substantial number of technological processes and operations in industry, transport, and agriculture are accompanied by the formation and liberation of dust, where large cohorts of workers are exposed to it.

*Characteristics of dust.* Knowledge of the origin and conditions of the industrial dust formation, its physico-chemical properties, and specific effects on the human body are important not only in improving the working conditions of employees, but also in the subsequent diagnosis and treatment of respiratory diseases, as well as the development of integrated engineering, technical, and sanitary and hygienic preventive measures.

*Dust* is air suspended, slowly settling solid particles, ranging in size from a few tens to a fraction of a micron. Dust is an aerosol, i.e. a dispersed system in which the disperse phase is solid particles and the dispersion medium is air.

The most widely used classification of dust is by the formation method, origin, dispersion, and type of activity (Table No. 18).

**Table No. 18.** Aerosol classification.

By formation method	By origin	By dispersion	By type of activity
1. Disintegration aerosols	ORGANIC 1.1. Herbal 1.2. Animal 1.3. Artificial	1. Large-dispersed visible, more than 10 µm	1. Specific diseases of the respiratory system (pneumoconiosis, dust bronchitis).
2. Condensation aerosols (during evaporation and subsequent condensation)	2. INORGANIC 2.1. Mineral 2.2. Metal  3. MIXED	2. Medium-dispersed - microscopic, from 0.25 to 10 µm  3. Finely dispersed ultramicroscopic, less than 0.25 µm	2. Nonspecific diseases: 2.1. Skin 2.2. Eye 2.3. Lungs (pneumonia, tuberculosis, cancer, etc.)

*Disintegration aerosol* is formed as a result of mechanical disintegration of solid materials during explosion, crushing, grinding; *condensation aerosol* is formed in the sublimation of solids using electric gas welding, gas cutting, metal melting, etc., due to cooling and condensation of metal and non-metal vapors.

*Organic dust* can be of animal or vegetable origin (woolen, mixed fodder, bone, wood, cotton, linen, etc.); *inorganic dust* can be mineral and metal (quartz, silicate, cement, zinc, iron, copper, lead, etc.); *mixed dust* is widely found in the metallurgical, mining and chemical industries; *artificial dust* (dust of rubber, resins, dyes, plastics, etc.) is typical for petrochemical, paint, varnish, and other types of industrial production.

The particle size or the degree of aerosol dispersion, which determine not only the rate of dust settling, but also its delay and depth of penetration into respiratory organs, is of paramount importance for hygienic characteristics of the industrial dust. According to dispersion, the dust is divided into *finely dispersed* and

*ultramicroscopic* (dust particle size of up to 0.25 µm); *medium-dispersed* or *microscopic* (size from 0.25 to 10 µm); *coarsely dispersed* (larger than 10 µm).

Physical, physico-chemical and chemical properties of dust largely determine the nature of its toxic, irritating and fibrogenic effects on the human body. Not only its concentration in the air of the working zone or atmospheric air, but also the density and shape of dust particles, its adsorption properties, the solubility of dust particles and electric charge plays a key role in the type of general toxic and specific activity of dust.

Occupational aerosols, according to their damaging resultant effects, can be divided into aerosols of strongly fibrogenic activity (SFA) and aerosols, which are predominantly toxic, irritating, carcinogenic, and mutagenic. According to the classification (1996), depending on the pneumofibrogenic activity of dust, pneumoconiosis is divided into three groups: pneumoconiosis due to the activity of highly fibrogenic and moderately fibrogenic dust; pneumoconiosis due to the influence of slightly fibrogenic dust; and pneumoconiosis caused by the activity of aerosols of toxic-allergenic activity.

**Dust effect on the body.** Experimental and clinical observations have received a huge amount of scientific data on the pathogenesis of the dust effect on a living organism. There are several theories of the mechanism of the dust effect - mechanical, toxic-chemical, "colloidal", biological, and many others. These theories are based on the fact that macrophages phagocytizing dust particles containing free silicon dioxide (SiO<sub>2</sub>) play a leading role in the development of pulmonary lung diseases. The two-phase mechanism for the development of dust pathology is the damage by dust particles to phagocytic cell elements and, subsequently, the toxic effect of the vital activity products and the destruction of macrophages on the lung tissue.

Clinical and morphological studies have shown that fibrogenic dust can cause diseases in respiratory organs from the upper respiratory tract, formation of nodular and diffusive-sclerotic forms of pulmonary fibrosis-pneumoconiosis and chronic bronchitis.

According to the etiological sign, the following forms of pneumoconiosis are distinguished: silicosis, which develops due to the inhalation of dust containing free silica; silicosis, which occur when dust enters the lungs, in which silicon dioxide is in a bound state with other compounds (asbestosis, talcosis, polyvinosis, nephrenosis, etc.); carbon pneumoconiosis, caused by exposure to carbon-containing dusts (coal, coke, soot, graphite); heavy metal coniosis, developing under the influence of metal dust and their oxides (berylliosis, siderosis, aluminosis, baritosis, staniosis, etc.); pneumoconiosis, which develops as a result of inhalation of organic dust of animal, vegetable and synthetic origin (byssinosis, bagassos, mycosis, etc.); pneumoconiosis, caused by exposure to mixed dust containing free silica (anthracosilicosis, siderosilicosis, silico-silicatosis) and not containing it or with insignificant content.

Mechanisms of pathological reactions that develop in the body when exposed to metal dust, mixed and organic dust, have a number of characteristics. Thus, when inhaling metal dust with toxic properties, in parallel with the development of fibrosis in the lung tissue, symptoms of chronic intoxication are revealed. Pneumoconiosis, caused by the influence of mixed dust, is characterized mainly by interstitial changes in the lung tissue; the development of nodular fibrosis forms is also possible. Pneumoconiosis, caused by exposure to organic dust, is characterized by moderately severe pulmonary fibrosis, which is combined with allergic, bronchospastic and inflammatory changes in the bronchopulmonary system. Easier clinical course of the aforementioned forms of pneumoconiosis is observed more often than with silicosis.

In addition to silicosis and pneumoconiosis, under the influence of industrial dust, chronic bronchitis, pneumonia, asthmatic rhinitis, and bronchial asthma can develop. Certain types of fibrogenic dust can lead to the development of malignant neoplasms. Thus, the prolonged inhalation of asbestos dust is accompanied not only by the development of dust fibrosis (asbestosis), but also by the development of a pleural tumor (mesothelioma) and bronchial cancer. Irritant, sensitizing and photodynamic action of dust leads to the

development of allergic dermatitis, eczema, and folliculitis. Dust can influence the organ of vision and lead to inflammatory processes in the conjunctiva (conjunctivitis), and in some cases, it can also lead to the development of cataracts.

Unfavorable microclimatic conditions, the impact of some biological and physical factors of the operational environment can potentiate the adverse effect of the dust factor on the body and lead to the development of diseases from the respiratory organs.

**Hygienic rating of dust.** Methodical instructions "Measurement of aerosols concentrations of strongly fibrogenic activity" No. 4436-87 regulate the measurement of industrial dust concentrations, hygienic standards of which are established by gravimetric (weight) indicators, expressed in milligrams per cubic meter ( $\text{mg}/\text{m}^3$ ).

For aerosols of strongly fibrogenic activity containing free silicon dioxide, the hygienic regulation (MPC) for air in the working zone is  $1 \text{ mg}/\text{m}^3$  (with a content of  $\text{SiO}_2$  of 10% or more) and  $2 \text{ mg}/\text{m}^3$  (with a  $\text{SiO}_2$  content of less than 10%). For other types of dust, MPC in the air of the working zone is set from 2 to  $10 \text{ mg}/\text{m}^3$ . For dust containing natural asbestos, the mean-replaceable concentration is  $0.5 \text{ mg}/\text{m}^3$ , and the maximum one-time concentration is  $2.0 \text{ mg}/\text{m}^3$ . Currently, the maximum allowable concentrations for more than 100 types of dust that have a fibrogenic effect have been approved.

To characterize real working conditions, obtain reliable information about harmful factors of the operational environment and indicators of the health state of industrial workers, it is advisable to determine both the maximum single (MPC) and shift-average concentrations (SAC) of industrial premises air.

MPC is the concentration of aerosols determined by the results of continuous or discrete sampling of aerosol in the breathing zone of workers or the working zone for a time interval of 30 minutes, with process technology accompanied by maximum dust formation.

$$C_{MPC} = \frac{(M_1 - M_0)}{V_0} \cdot 1000,$$



where  $C_{MPC}$  – the concentration of all dust in the air,  $mg/m^3$ ,  $M_0$  – filter weight before dust sampling, mg;  $M_1$  – filter weight after dust sampling, mg;  $V$  – the volume of air passing through the filter and adjusted to normal conditions ( $V_0$ );

The value of the dust MPC ( $C_0$ ) for a discrete measurement equal to the duration of individual measurements within 30 minutes is calculated as the arithmetic mean of single concentrations using the formula:

$$C_0 = \frac{C_1 + C_2 + \dots + C_n}{n},$$

where  $C_1, C_2, \dots, C_n$  – measurement results,  $n$  – number of measurements.

Determination of the maximum single concentration, unfortunately, does not make it possible to establish the relationship between the dose of dust absorbed by the body and the degree of damage to the body. To establish the dose-time-effect relationship, it is necessary to determine the average mean concentration, which most fully reflects the presence of a biological relationship between the concentration of the dust factor and the state of human health.

$SAC$  is the concentration of aerosol, determined by the results of continuous or discrete sampling in the breathing zone of workers or the working zone for a period of time equal to at least 75% of the shift duration, for main and additional technological operations, and work breaks, taking into account their duration of shift.

When conducting sanitary inspection in the field of working conditions related to the determination of the dust content in the working zone air and, if the mean concentration is exceeded, the assessment of the dust load (DL) on the worker is necessary.

*The dust load* on respiratory organs of the worker is a real or predictive value of the total exposure of the dust dose that the worker inhales over the entire period of actual or perceived professional contact with the dust factor.

DL on workers' respiratory organs (or a group of workers if they perform similar work under the same conditions) are calculated on the basis of the actual SFA  $K_{cc}$  in air of the working zone, the

volume of pulmonary ventilation (depending on the severity of labor), and the duration of exposure to dust:

$$DL = K_{cc} \times N \times T \times Q$$

where  $K_{cc}$  – the actual average weight concentration in the worker's respiratory zone of the employee;  $N$  – the number of shifts in a calendar year (for example, 248);  $T$  – the number of years of contact with SFA;  $Q$  – the volume of pulmonary ventilation per shift,  $m^3$ .

According to SanPiN "Sanitary and epidemiological requirements for industrial premises air" No. 355 of 14.07.2005, SanPiN "Hygienic requirements for the microclimate of industrial premises" No. 355 of July 14, 2005, the Ministry of Health of the Republic of Kazakhstan recommends the use of the following average values for volumes of pulmonary ventilation that depend on the level of energy expenditure and, accordingly, categories of work. For works of Ia-Ib category, pulmonary ventilation per shift is  $4 m^3$ , for IIa-IIb category -  $7 m^3$  and III category -  $10 m^3$ .

To obtain the actual or predicted value of the dust load, the latter can be calculated for any period of work in contact with dust.

The obtained values of the actual dust load are compared with the reference dust load (RDL), the value of which is calculated depending on the actual or expected service life, dust limit and category of work:

$$RDL = MRL_{cc} \cdot N \cdot T \cdot Q,$$

где  $MRL_{cc}$  – mean-value MRL,  $mg/m^3$ ;  $N$  – number of workers in a calendar year;  $T$  – number of years of contact with SFA;  $Q$  – volume of pulmonary ventilation per shift,  $m^3$ .

When developing the algorithm of the sanitary measures' system (Figure 18), basic hygiene requirements should be presented not only for the knowledge of the physico-chemical properties of dust, its toxicity and hazard, but also for technological processes and equipment, ventilation, construction and planning solutions, rational maintenance of workplaces, and the use of personal protective equipment. In this case, it is necessary to be guided by the sanitary and hygienic rules and norms that define the relevant requirements for technological processes and operational equipment.

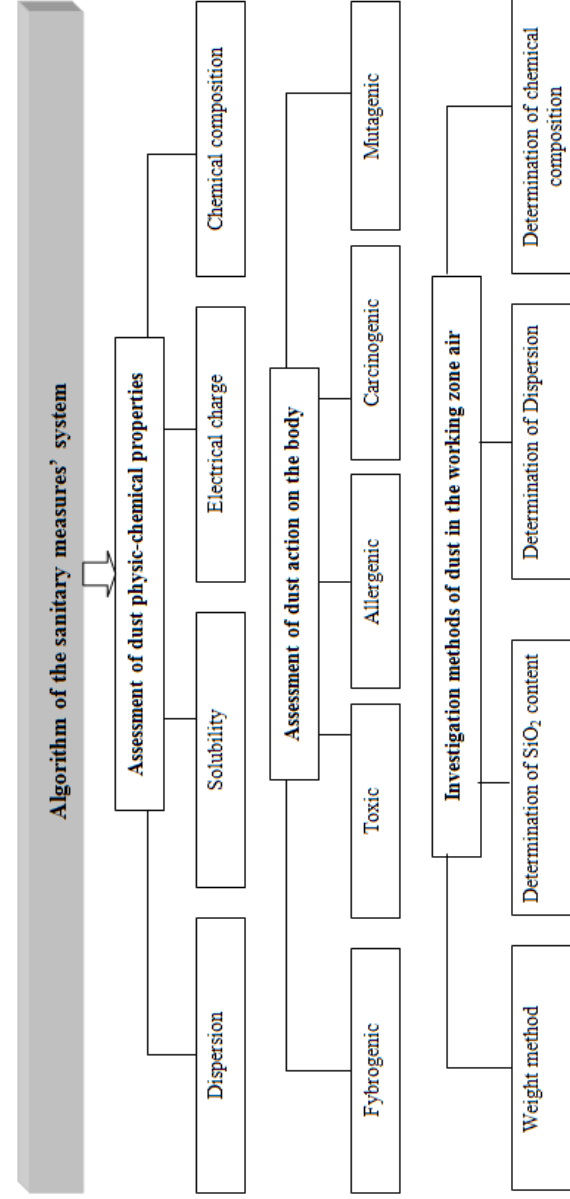


Figure № 18

**Preventive measures.** Actions to limit the adverse effects of dust on workers in operational conditions should include measures of technological, sanitary, medical, preventive and organizational nature. A key role in the system of preventive measures are legal acts that regulate the MRL values of aerosols in the working zone air; sanitary rules for organization and maintenance of industrial enterprises are defined, methodological recommendations for prevention of occupational diseases of the respiratory system and many others are formulated.

Technological measures to control industrial dust include closed and semi-closed cycles and non-waste production, provided by sanitary and technical ventilation (Figure No.19).

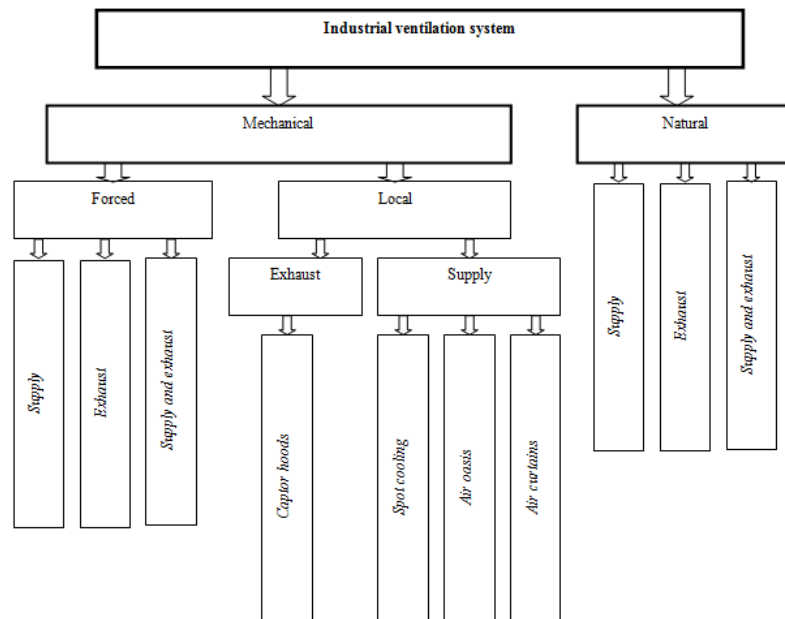


Figure № 19

Being the most important sanitary and technical measure aimed at reducing the level of dustiness in the operational

environment, ventilation allows localizing the source of dust formation and preventing its spread throughout the entire operational premises. For this purpose, exhaust ventilation ducts should be as close as possible to the source of dust formation and ensure the optimum air speed in the section of the exhaust ventilation duct. Ventilation, as a preventive measure, should be applied in combination with technological actions.

An effective measure for prevention of the dust formation is the complex automation and mechanization of labor processes and change of production technology. A number of engineering activities aimed at controlling the air dust is based on the use of water used to moisten materials - sources of dust, regular wet cleaning of industrial premises and workplaces. Additional means of protecting the respiratory organs from exposure to dust are personal protective equipment (PPE) - respirators, masks, helmets, uniforms.

Preliminary (before entering the workplace) and routine medical examinations are the main medical preventive measures to protect workers from exposure to industrial dust. A significant role in the system of preventive measures aimed at increasing the reactivity and resistance of the organism is given to providing workers with medical and preventive nutrition and milk, vitamin supply, and rational organization of work time and breaks. Activities related to the impact of dust should be performed for diagnosis, treatment, examination of work capacity and employment of sick workers.

#### 6.2.4. Industrial poisons

Anthropogenic impact on ecosystems and humans has in many ways become decisive. In the Republic of Kazakhstan, a number of regions have already been declared zones of ecological disaster. Currently, about 60,000 chemical compounds are widely used from six million chemicals discovered by science, to which about 1,000 new substances are added each year. Industrial poisons in the form of raw materials, intermediate or finished products are found in operational conditions and upon entry into the body cause disruption of its vital activity [41-44]. Technological processes based

on the use of chemicals are used practically in all major industries (metallurgy and machine building, oil and gas production, petrochemistry, air and shipbuilding, radio electronics, agronomy production, etc.).

The industrial poisons include two large groups: *inorganic substances* (halides, sulfur compounds, nitrogen compounds, phosphorus and its compounds, arsenic and its compounds, carbon compounds, cyanide compounds, heavy metals) and *organic substances* (aromatic hydrocarbons, chlorine derivatives and nitroamine derivatives, fatty hydrocarbons, chlorinated fatty hydrocarbons, fatty alcohols, ethers, aldehydes, ketones, acid esters, heterocyclic compounds, terpenes).

The widespread use of polymeric, synthetic and natural compounds and complex products with allergen properties in various branches of industry and agriculture, as well as the expansion of the microbiological industry for the manufacture of various biologically active preparations and products, led to a significant increase in the cohort of workers who have professional contact with allergens. One of the most urgent sanitary and hygienic problems is contamination of industrial and residential environments with biologically active polychlorinated aromatic compounds (dioxins), which have high environmental stability and toxicity.

***Characteristics of industrial poisons.*** In the system of comprehensive preventive measures aimed at preventing the harmful effects of chemicals on workers, an important role belongs to *industrial toxicology*, which studies the effect of industrial poisons on the body, with the goal of creating harmless and safe working conditions.

The main objectives of industrial toxicology, formulated in the late twenties of the last century by N.S. Pravdin, are: 1) hygienic rating of the hazardous substance content in the operational environment (by establishing the maximum permissible concentrations (MPC) in the working zone area); 2) hygienic inspection of toxic substances (includes toxicological assessment of industrial poisons by determining the lethal doses and concentrations for various routes of administration, determining cumulative

properties and thresholds for adverse effects, evaluating skin irritation, skin resorptive and sensitizing effects, studying long-term effects); 3) hygienic rating of raw materials and products (providing for limiting the content of toxic compounds in industrial raw materials and finished products, taking into account their harmfulness and hazard).

***Classification of industrial poisons.*** In preventive toxicology, there are several classifications of industrial poisons based on chemical properties and the nature of the activity, degree of toxicity and hazard (Figure No. 20).

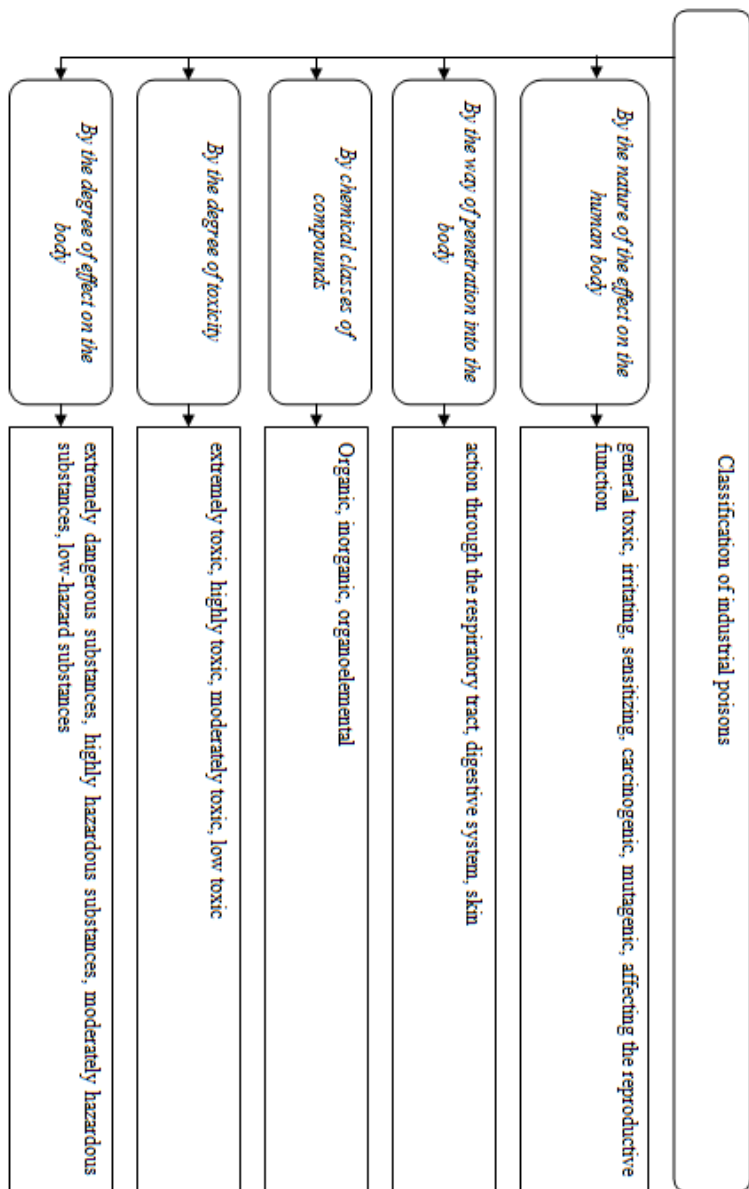


Figure № 20

To develop preventive measures, industrial poisons are classified according to their toxic and biological properties, as asphyxiating, irritating, narcotic substances and substances acting on the hematopoietic system, parenchymal and nerve poisons. There is also a classification of industrial poisons by their interaction with enzyme systems; allergens, teratogens, mutagens, carcinogens are distinguished by specific toxic effects distinguish.

Chemical substances that have carcinogenic and cocarcinogenic effects under experimental conditions are classified into three classes: high, medium and low carcinogenic activity. Chemicals by the degree of carcinogenic activity for humans, according to the International Agency for Cancer Research (IARC, 1982), are divided into substances with proven carcinogenicity for humans and substances with possible carcinogenicity for humans. There is also a classification of carcinogenic compounds by chemical structure.

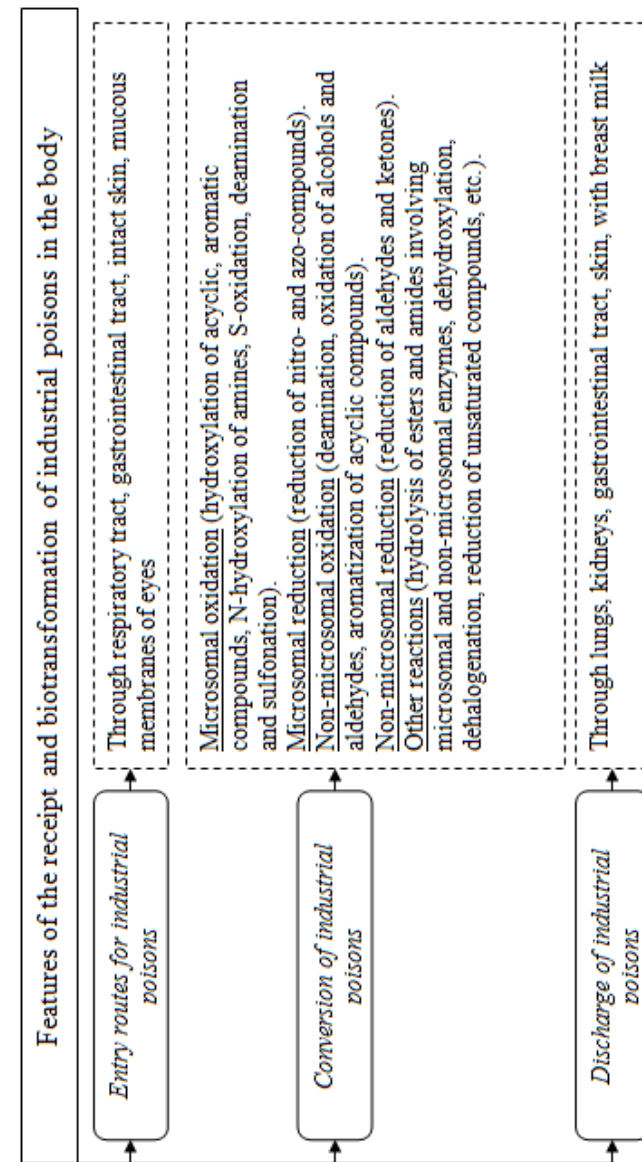
**The effect of industrial poisons on the body.** The physicochemical properties of industrial poisons largely determine their intake, distribution and the character of excretion from the body. In this case, the distribution of chemical substances depends on a number of factors. Industrial organic poisons, being non-electrolytes, are very well spread by blood to various organs and tissues, and many inorganic poisons and, in particular, metals, are deposited in them.

The industrial poisons that enter the body undergo various chemical transformations, that result, in most cases, in less toxic products, easily removed from the body. At the same time, some hazardous substances are not easily amenable to biotransformation and metabolism, where the number of them in tissues does not change, and in some cases with chronic admission, they increase. The main biochemical reactions of metabolism are oxidation, reduction, hydrolytic cleavage, formation of paired compounds with certain biosubstrates, as well as deamination, methylation and acetylation (Figure No. 21).

The toxic effect of industrial poisons is extremely diverse, but a number of general laws have been established with respect to

the ways of their entry into the body, absorption, distribution and transformation in the body, isolation from the body, nature of the industrial poisons' activity in connection with their chemical structure and physical properties.

The main and most dangerous way of entering chemicals into the body is the inhalation route. Considering the large surface of the pulmonary alveoli (90-100 m<sup>2</sup>) favorable conditions are created for penetration of gases, vapors and dust into the blood. The risk of poisoning by inhalation of gases, vapors, aerosols, as well as steam-gas-aerosol mixtures depends on the degree of their solubility in water and fats, which in turn is determined by the chemical structure of the poison. With the increase of the pulmonary respiration volume and blood flow rate, the sorption of the poison occurs faster, therefore, when doing physical work or staying at high air temperatures, when the volume of breathing and the blood flow rate increase sharply, poisoning can occur faster.



**Figure № 21**

In operational conditions, the entry of hazardous substances into the body through the gastrointestinal tract is relatively rare. Poisons most often enter the oral cavity from contaminated hands. It is also possible to swallow poisonous substances from air when they are delayed on the mucous membranes of the nasopharynx and the oral cavity. In the gastrointestinal tract, the absorption of poisons occurs mainly in the small intestine and only to a small extent in the stomach. The acidic environment of gastric juice, the solubility of hazardous substances in lipids, and the nature of the food consumed have a significant effect on the absorption of toxic substances and their entry into the liver.

The amount of chemicals that can penetrate the skin is directly dependent on their solubility in water, the area of skin contact surface, and the blood flow velocity in it. Hazardous substances can penetrate through the skin epidermis, sweat and sebaceous glands, hair pouches that are readily soluble in fats and lipids. These are primarily non-electrolytes (aromatic and fatty hydrocarbons, their derivatives, organometallic compounds); electrolytes, which dissociate into ions, do not penetrate through the skin.

Hazardous substances trapped in the body are released through lungs, kidneys, gastrointestinal tract, and skin. The biological half-life period (the time needed to reduce the body's concentration or in certain organs of the substance's concentrations by 50%) has a time dependence, since the highest rate of hazardous substances' elimination is observed in the first days of poisoning, followed by a slower elimination of poisons from the body.

The pathological processes developing under the influence of industrial poisons are extremely variable and differ in the depth of their disturbance, which in turn are stipulated not only by the concentration (dose) of the hazardous substance that has arrived, the time of action and the period of discharge from the body, but also the individual, age, and sex sensitivity.

Many poisons, in addition to general toxic effects, have a pronounced specific effect on certain enzyme systems of the body,

block the synthesis of nucleic acids and protein, damage the structural integrity of the cell membrane formations and intracellular structures, and the uniform blood elements.

The regularities of metabolic disturbances presented are accompanied by functional and organic lesions of various organs and systems. The effect of certain industrial poisons is characterized by selective damage to the central and peripheral nervous system, manifested by neurointoxication and neurotoxicosis. The primary defeat of the respiratory system, which occurs with acute inhalation, leads to the development of several clinical syndromes (acute toxic laryngopharyngotracheitis, acute toxic bronchitis and bronchiolitis, acute toxic pulmonary edema, acute toxic pneumonia).

When exposed to hepatotropic poisons, the clinical pattern of intoxication is characterized by the development of cholestasis and toxic hepatitis. The defeat of the urinary system is accompanied by involvement in the pathological process of kidneys and the development of toxic nephropathy. Long-term exposure to certain industrial poisons and, in particular, aromatic amine compounds can lead to the development of benign and malignant tumors of the urinary tract.

***Toxicometry of chemical substances.*** To prevent the negative consequences of the effect of industrial poisons on the health of workers and general population, a system of preventive measures has been developed, among which one of the main activities is a toxicological assessment of chemicals. Toxicometry represents a set of methods and techniques for the quantitative assessment of toxicity and hazard of poisons. It is a methodological basis for industrial toxicology and eco-toxicology and occupies a special place in assessing the degree of toxicity and hazards of chemicals and their compositions.

Toxicometry of chemical substances includes a wide range of studies and assessments, but among them are mandatory stages such as the establishment of lethal effects, identification and quantification of cumulative properties, study of skin irritant, skin-resorptive, sensitizing action, chronic exposure to the body to establish thresholds of the hazardous effect. The toxic-kinetic and metabolic

evaluation criteria, study of such distant effects as blastomogenesis and mutagenesis, and effect on the reproductive system are of particular importance. Table No. 19 lists the criteria for the chemicals' hazard class based on the leading toxicometric indicators.

**Table No. 19.** Criteria for the chemicals' hazard class.

Factor name	Hazard class name			
	I	II	III	IV
Maximum Permissible Concentration (MPC) of hazardous substances in the working zone air, mg/m <sup>3</sup>	<0.1	0.1-1.0	1.1-10.0	> 10,0
Average lethal dose when injected into stomach, mg/kg	>15	15-150	151-5000	> 5000
Average lethal dose when applied to skin, mg/kg	< 100	100-500	501-2500	> 2500
Average lethal concentration in air, mg/m <sup>3</sup>	< 50	500-5000	5001-50 000	> 50 000
Index of potential inhalation toxicity (IPIT)	< 300	300-30	29-3	< 3
Acute action zone	< 6	6.0-18.0	18.1-54.0	> 54.0
Chronic action zone	> 10.0	10.0-5.0	4.9-2.5	< 2.5

*Toxicometry* is a toxicology section devoted to the determination of toxicity and hazard of chemical compounds. Toxicometry is a system of principles and methods for the quantitative assessment of toxicity and hazard of poisons.

Toxicometric information shall necessarily include not only the upper toxicity indices (fatal concentrations and doses), but also the lowest ones, at which the initial changes in metabolic processes in the body occur. The most significant indicators in the toxicity characterization of poisons for the fatal effect are the average lethal concentration in air (CL<sub>50</sub>), average lethal dose (DL<sub>50</sub>) when injected into stomach or by other routes.

CL<sub>50</sub> is the concentration that causes the death of 50% of experimental animals during inhalation effect of substances at a certain exposure and a certain period of follow-up.

DL<sub>50</sub> is the dose that causes the death of 50% of experimental animals when introduced into stomach, into abdominal cavity, when applied to skin, and others under certain conditions and a certain period of follow-up.

The basis for establishing safe levels of chemicals in various environmental objects is the concept of threshold for harmful effects of poisons, which determines that for each chemical that causes some adverse effects in the body. There are doses (concentrations) at which the change in body functions will be minimal (threshold). The threshold of all action types is the leading principle of hygiene and preventive toxicology.

*Lim<sub>ac</sub>* is the threshold of a single (acute) action - the minimum concentration (dose), causing changes in biological indicators at the level of the whole organism, which go beyond the limits of adaptive physiological reactions.

*Lim<sub>ch</sub>* is the threshold of chronic action - the minimum concentration causing harmful effects in a chronic experiment for 4 hours five times a week for less than 4 months.

*Lim<sub>ch sp</sub>* is the threshold of distant effects - the minimum concentration (dose) of a substance that causes changes in biological functions of individual organs and body systems that go beyond the limits of adaptive physiological reactions under conditions of chronic exposure.

Determination of average lethal concentrations and doses and thresholds of harmful action is necessary for assessing the hazard of hazardous substances, establishing the possibility of acute and chronic poisoning and establishing safe concentrations by calculation methods. The likelihood of harmful effects on health in real operational conditions, or the use of chemicals, is a characteristic of a substance such as the substance hazard. Currently, two groups of quantitative hazard indicators have been distinguished: the criterion of potential hazard (the potential for the entry of hazardous substances into the body) and the criterion of a real hazard (compensatory properties of the organism in relation to poison).



One of the ways to increase the reliability of developed hygienic regulations of chemicals in the operational and surrounding environments is a record and use of adaptive reactions of the organism. However, in the practice of hygienic regulations, the threshold and maximum permissible concentrations of hazardous substances are established without taking into account the state of the organism's adaptive processes.

In this aspect, it is important to distinguish between true physiological adaptive reactions (adaptation) from a hidden, temporarily compensated pathology in conditions of scientific justification of harmful effect thresholds of chemicals on the body.

*Adaptation* is a true adaptation of the organism to changing environmental conditions that occurs without reversible disturbances of this biological system and without exceeding the normal (homeostatic) abilities of its response.

*Compensation* is the adaptation of the organism to changing environmental conditions caused by the emergence of tension in homeostasis systems that exceed the limits of normal (natural) possibilities. Compensation is a temporary hidden pathology and can eventually be detected in the form of obvious pathological changes (decompensation).

During long-term effects of industrial poisons and the reduction of protective immunological reactions, a quick disruption of adaptation occurs and the phase of physiological adaptation passes into the phase of compensated pathology. In this case, industrial toxins in high doses can lead to significant morpho-functional damage to internal organs and body systems.

The potential hazard indicator characterizes the Index of potential inhalation toxicity (IPIT). An analysis of the hazard assessment for various industrial poisons in terms of IPIT shows that in a number of cases a low-toxic but highly volatile substance may be more dangerous in the development of acute poisoning than a highly toxic but low-volatile compound.

*IPIT* is a possibility factor of inhalation poisoning - the ratio of the maximum achievable concentration of the substance in air at 20°C to the average lethal concentration of the substance for mice.

For the purpose of characterizing the compensatory capabilities of the body, its ability to neutralize, discharge the substance and restore damaged functions in a single exposure, the calculation of the acute (single) action zone ( $Z_{ac}$ ) is used; and in the chronic action of the substance, the chronic action zone ( $Z_{ch}$ ) is calculated. The chronic intoxication hazard is directly proportional to the magnitude of the chronic action zone, that is, the wider chronic action zone, the greater the risk of chronic poisoning, and vice versa (Table No. 20).

**Table No. 20.** General scheme of toxicometry parameters.

<i>Primary (Experimental)</i>	<i>Derivative</i>
Lethal doses or concentrations: $CL_{50}$ , $CL_{16}$ , $CL_{84}$ , $DL_{50}$ , etc.	Lethal action zone $Z_l = \frac{CL_{84}}{CL_{16}}$ OR $\frac{DL_{84}}{DL_{16}}$
Interspecific sensitivity coefficient (ICS)	Acute action zone $Z_{ac} = \frac{CL_{50}}{Lim_{ac}}$
Threshold of acute integral action $Lim_{ac (integr.)}$	Specific action zone $Z_{sp} = \frac{Lim_{ac sp}}{Lim_{ac}}$
Threshold of selective (pathogenetic action) $Lim_{ac sp}$	
Cumulation coefficient $C_{cum}$	
Threshold of chronic action $Lim_{ch (integr.)}$	Chronic action zone $Z_{ch} = \frac{Lim_{ch}}{Lim_{ac}}$
Threshold of remote effects* $Lim_{ch sp}$	Biologic action zone $Z_{biol} = \frac{CL_{50}}{Lim_{ch}}$
Safe levels of impact for SRLI, MPC, PRQ, etc.	Коэффициент запаса $I_s = \frac{Lim_{ch}}{MPC}$

\* Currently, the threshold of long-term effects (accelerated aging, carcinogenesis, mutagenesis, gonadotropic and embryotropic action, etc.) is taken into account.

$Z_{ac}$  is an acute action zone - the ratio of the average lethal concentration of the substance to the threshold of a single action.

$Z_{ch}$  is a chronic action zone - the ratio of the threshold of a single action to the threshold of a chronic action.

Taking into account the variety of general toxicity and specific (skin-irritating, skin-resorptive) actions of chemical substances on the body, the nature of biotransformation of industrial poisons and characteristics of discharge, toxicometrical parameters, such as the calculation of the biological action zones ( $Z_{biol}$ ) and specific action zones ( $Z_{sp}$ ) are used.

$Z_{biol}$  is a biological action zone - the ratio of the average lethal concentration to the threshold of chronic action.

$Z_{sp}$  is a specific action zone - the ratio of the acute action threshold, established by integral indicators, to the threshold of acute action by specific indicators.

The hazard of toxic substances for humans is largely determined by their ability to accumulate, so studying cumulation is an indispensable condition for toxicological characteristics of a chemical substance and is necessary for their hygienic regulation. Cumulation processes often cause the development of chronic poisoning. When the poison itself is accumulated in the body, it is a *material cumulation*, and with the accumulation of changes in the body (biochemical, histochemical, functional, etc.) that occur upon repeated exposure to a chemical substance, it is a *functional cumulation*.

The quantitative evaluation of the functional cumulative effect of a hazardous substance is called the *cumulation factor* ( $C_{cum}$ ) and is defined as the ratio of the total dose received by the body with repeated experimental injection of the substance in an amount equal to the average dose (concentration), i.e.  $DL_{50}$ , to the same value, but with a single injection.

$$C_{cum} = (\sum DL_{50}) / DL_{50}$$

The inverse ratio of these two quantities ( $S$ ) is called the degree of cumulation and is usually expressed in percentages. According to the cumulative effect, all toxic substances are also divided into four groups:

- overcumulative ( $C_{cum} < 1, S > 100$ );
- pronounced cumulative ( $C_{cum} = 1 \sum 3, S = 100 \sum 34$ );
- medium cumulative ( $C_{cum} = 3 \sum 5, S = 33 \sum 20$ );
- low cumulative ( $C_{cum} > 5, S < 20$ ).

**Hygienic rating of industrial poisons.** The history of the formation and development of occupational medicine is inextricably linked with the development of methodological foundation for improvement of the working environment and prevention of occupational diseases. Hygienic rating of factors affecting a person in the process of labor activity is the main link in creating safe working conditions and a rational work process. Therefore, the hygienic regulation of the hazardous substance content in the working zone air and other environmental objects (HN "Maximum permissible concentration (MPC)) of hazardous substances in the working zone air" No.1.02.011-94, MG "To the formulation of studies for the substantiation of sanitary standards for hazardous substances in the working zone air" No. 2163-80 of 04/04/1980, MG "On the application of the calculation method for substantiating SRLI of hazardous substances in the working zone air" No. 1599-77 of 02.02.1977, M.).

When establishing MPC of hazardous substances in the working zone air, the following principles are used: 1) the principle of priority of medical indications before the modern technical feasibility and other technical and economic criteria; 2) the principle of ensuring the advance of standards development for the introduction of new chemical compounds into production.

Hygienic rating is based on the recognition of the threshold principle of all action types for chemical compounds (including mutagenic and carcinogenic) on the whole organism and shall take into account the need for an integrated approach to establishing thresholds for harmful effects.

Hygienic rating of new chemicals is carried out in three phases: 1. rationale for the safe reference levels of impact (SRLI); 2. substantiation of MPC; 3. adjustment of MPC by comparing working conditions of workers.

The first phase is timed to the period of laboratory development of new compounds; the second phase - to the period of semi-plant tests and design of productions; the third phase is carried out after the introduction of substances into production in terms established depending on the substance toxicological characteristics and the hygienic characteristics of production, but no later than 3-5 years from the moment of introduction.

*MPC (maximum permissible concentrations of hazardous substances in the working zone air)* - concentrations that, with daily (except for days off) work for 8 hours or for a different duration, but not more than 41 hours a week during the whole working period, cannot cause diseases or abnormalities in health detected by modern research methods in the course of work or in the long-term life of this and subsequent generations.

MPC in the working zone air is established for chemical compounds that have harmful effects, which can be found in air in the form of gases, vapors, aerosols, and mixtures of vapors and aerosols.

The maximum single and the shift-average concentration are determined for highly cumulative substances. The cumulative degree is determined for each substance by determining the cumulation coefficient, zone of biological and chronic action, and when adjusting the MPC, it is based on the results of repeated clinical and hygienic observations.

*Maximum single concentrations* are mainly used for hygienic assessment of the process and equipment.

*Shift-average concentrations SAC* is the average concentration obtained with continuous or intermittent sampling of air for a total time of at least 75% of the shift duration, or the weight-average concentration during the whole shift in the breathing zone of those working at places of permanent or temporary residence.

Controlling the shift-average values of MPC is necessary and important both for obtaining an integral criterion for assessing the operational environment and for a more adequate analysis of the dependence of health indicators on working conditions. This is especially useful when analyzing the data of occupational health

examinations of workers, establishing the professional etiology of diseases, forming "risk groups" in the medical examination of industrial and agricultural workers, as well as other categories of workers.

In some cases, there is a need for an accelerated justification of hygienic regulations for new chemicals. The accelerated methods of justifying the MPC of hazardous substances in the working zone air include methods that allow, at the present level of knowledge, to reduce the overall program for substantiating MPC of hazardous substances without compromising the accuracy of determining the MPC value.

It is advisable to reduce the amount of research on the justification of MPC for new chemicals in the following cases: 1. when the substance belongs to the homologous series, whose representatives have an approved MPC value for the working zone air; 2. when substances belong to the class of studied compounds with a known mechanism of action; 3. for substances with legally established sanitary standards in the atmosphere of populated areas, in water and other environments in terms of indicators of general toxicity; 4. if there is an appropriate method for accelerated substantiation of MPCs.

At the same time, a full toxicological research, when developing hygienic regulations, includes substances that have been widely introduced into practice and related to unexplored or little-studied classes of compounds, as well as those dangerous for the development of remote and irreversible effects.

To substantiate MPC and other preventive measures in experimental animal studies, it is necessary to obtain the following scientific data:

- information on the toxicity and activity nature of the substance with a single exposure to the body;
- assessment of harmful effects' threshold during a single entry of a substance into the body;
- evaluation of cumulative properties of the substance when the substance is re-exposed to the body;

- establishment of the harmful effects' threshold during chronic entry of a substance into the body;
- justification of the safety factor;
- study of local irritant and skin-resorptive actions of the substance.

It is also necessary to have information not only about the chemical structure and physicochemical properties of the substance, but also about the conditions for its production and application.

For the period preceding the production design, SRLI is established by using calculation according to physicochemical properties or by interpolation and extrapolation in series close in connection structure or by acute toxicity indicators. SRLI shall be reviewed two years after their approval or replaced by MPC, taking into account the accumulated data on the ratio of health indicators of workers to working conditions.

In natural conditions of the operational environment, humans are affected by various environmental factors. In this case, the characteristics of this influence are either the simultaneous presence of several chemical compounds, or a combination of chemical and physical factors, as well as the possibility of penetration of the same chemical substance into the body in different ways - by air, water, and food. The urgency of this problem was noted by N.V. Lazarev in 1938, who wrote: "It is not enough to know which poisons and in what amount are contained in the air, we need to know how they will act in a joint presence."

The most studied effect in occupational health and industrial toxicology is considered to be a combined effect of chemical compounds. Currently, *combined effect* is a simultaneous or sequential action on the body of several substances with the same pathway or several physical factors. Industrial workers can be exposed to the combined action of chemicals used as raw materials, intermediate and final products, and chemical compounds that are impurities or by-products of the technological process and chemical compounds that are formed in the atmosphere due to conversions during interaction of substances with each other.

In accordance with recommendations of the WHO Expert Committee, the following definitions of the combined action types are adopted:

- additive type (summation) is a type of combined action of chemical substances, in which their joint action is equal to the sum of the effects arising from the isolated action of substances;
- more than additive action (potentiation) is a type of combined action, in which its combined effect exceeds the sum of the effects of each substance included in the combination, with their isolated effect on the body;
- more than additive action (synergy) is a type of combined action, in which the effect of one factor is enhanced by the effect of the other or interaction with it;
- less than additive action (antagonism) is a type of combined action, in which the joint effect is less than the sum of the effects of each substance entering the combination, with their isolated action on the body.

*The complex action problem* of any particular chemical substance that enters the human body simultaneously with air, water and food is important and interesting. An interest in studying the *combined effects* of harmful factors in the operating environment and labor process is explained by their high prevalence both in operational conditions and in other spheres of human activity.

The implementation of the aforementioned types of interaction of chemical compounds and their combinations with other factors occurs through a certain biological effect. Therefore, evaluation of severity of this effect is important for hygienic rating. Although principles and methods for revealing the characteristics of combined, complex, and associated actions of the operational and natural environment factors have been proposed at present time, the issues of their hygienic regulations are still poorly developed. This is due to methodological justification for the types of unfavorable factors of the working environment and the labor process that remain an extremely complicated scientific problem.

Human's production activity, related with the wide use of chemicals in various branches of industry and agriculture, which has

a global character of environmental pollution, predetermined the need for international cooperation in the field of protecting human habitats. Such cooperation is the only opportunity to implement activities to eliminate chemicals, control the biosphere as a whole and protect the health of the working population through international chemical safety programs in conjunction with the ILO, WHO, and UNEP.

Hygienic standards of factors of the working environment and the labor process are developed mainly in some countries of the former USSR, the USA and the FRG. As a rule, most countries use hygienic standards developed in the aforementioned countries in their practical activities.

In most countries, MPC of hazardous substances for operational conditions is represented by the shift-average and, in some countries, by the maximum and shift-average values. Table No. 21 shows selective domestic and foreign standards for the content of hazardous substances in the working zone air ( $\text{mg}/\text{m}^3$ ).

Differences in methodological approaches for justification of MPC in the working zone air have caused a difference in their values. In the CIS countries, for most chemicals they are lower than in the US and other Western countries. In most countries, MPC of hazardous substances in the working zone air is represented by the shift-average, and in some far-abroad countries – by the maximum and shift-average values.

In the USA, the Threshold Limit Value (TLV) is the norm, in West Germany - the maximum permissible concentration (Maximale Arbeitsplatz Konzentrationen gesundheitsschädlicher Arbeitsstoffe - MAK-Verte).

*TLV* is a concentration of substances in the air, the daily impact of which does not cause any adverse reactions to the majority of workers. However, due to a wide variability and individual sensitivity, a small percentage of workers may experience discomfort from exposure to certain substances at concentrations equal to or below the threshold limits; a small percentage of workers may have more serious changes due to worsening of the previous state of health or the development of occupational disease.

*MAK-Verte* is the maximum permissible concentration of a substance in the form of gas, vapor, or suspended particles in the working zone air, which, in accordance with the current state of knowledge, even with repeated and prolonged daily exposure for 8 hours (in four changeable plants - 42 hours a week on the average of 4 consecutive weeks) does not cause harm to the health of workers and their offspring and does not burden them.

Establishment of hygienic standards for new chemicals in the working zone air and other environmental objects using traditional methods is long and time consuming and requires high material costs. In this regard, the development of rapid methods for study and prediction of safe levels of exposure to chemicals and their regulation is of particular importance.

**Table No. 21.** Domestic and foreign standards (recommendations) for hazardous substances' content in the working zone air (mg/m<sup>3</sup>).

Substances	Kazakhstan	USA	Switzerland	Finland	Germany	Sweden
Nitrogen oxides	5	9.3	9.3	9.3	9	9
Ammonia	20	18/27	18	18	35	18
Arsenious hydrogen (arsine)	0.1	0.2	0.16	0.2	0.2	0.05
Manganese	0.3	5	5	5	5	2.5-5
Mercury	0.01	0.05/0.15	0.05	0.05	0.1	0.05
Lead	0.01	0.15/0.45	0.15	0.15	0.1	0.15/0.3
Hydrogen sulfide	10	15/27	15	15	15	15
Carbon disulphide	1	60/90	30	30	30	30
Toluene	50	375/560	380	750	750	375
Carbon oxide	20	55/440	55	55	55	40
Carbon tetrachloride	20	65/160	65	65	65	65
Phenol	0.3	19/38	19	19	19	19
Chlorine	1	3/9	1.5	3	1.5	3
Zinc oxide	6	5/10	5	5	5	5
Sulfur anhydride	10	13	13	13	13	5
Aniline	0.1	19	19	19	19	19
Acetone	200	2400/3000	2400	2400	2400	1200
Gasoline fuel	100	-	1100-1400	-	-	1400
Gasoline solvent	300	-	800-2000	-	-	1400
Benzene	5	30	32	32	-	30
Vinyl chloride	30	510	25	520	-	3/15
Hydrogen chloride	0.5	2	1	2	2	2
Hexachlorobenzene	0.9	-	-	-	-	-
Heptachlor	0.01	0.5/1.5	0.5	0.5	0.5	-
Sulfuric acid	1	1	1	1	1	1
Hydrochloric acid	5	7	7	7	7	7
Xylene	50	435/655	435	435	870	435
Tiuri	0.5	5/10	5	5	5	-
Toluene in cyanate	0.05	0.14	0.14	0.14	0.14	0.07
Trinitrotoluene	1	0.5	1.5	1.5	1.5	-
Trichlorethylene	10	535/80	260	260	260	160
Formaldehyde	0.5	3	1.2	3	1.2	3
Phosgene	0.5	0.4	0.2	0.4	0.4	0.2
Chlorodioxide	0.1	0.3/0.9	0.3	0.3	0.3	0.3
Chlorotryn	-	0.7	0.7	0.7	0.7	-

The methodology for the SRLI substantiation is carried out mainly with the help of accelerated methods, developed mainly on the theory where the structure of chemical compounds and physical and chemical properties are related to their toxicity and action nature. Currently, many mathematical formulas, including toxicity indicators, have been recommended for calculating SRLI. Based on the revealed principles, the forecasting of safe levels of chemical substances in the working zone air, atmospheric air, and water of household and cultural-social use reservoirs is regulated.

Existing in the world various information systems for chemicals are not always available to experts and specialists and, unfortunately, do not provide the required completeness of information. According to the decision of the United Nations Conference on the Environmental Protection (Stockholm, 1972), the International Register of Potentially Toxic Chemicals (IRPTC) was established in 1976, which currently has a database on the toxicity and hazards of the most common chemicals and plays an important role in the intensification of the exchange of this information between countries.

Given that the hygienic rating of chemicals in a number of countries has a fundamental difference, leading to certain difficulties in the process of creating uniform international standards for the content of hazardous substances in environmental objects, it seems important to streamline the volume of toxicometry indicators for evaluation of new chemicals. Currently, steps have been taken towards unification of the main terms and concepts of toxicology, classification of toxicity and hazard, as well as requirements for methodological support for toxicometry of hazardous substances. The WHO Regional Office for Europe has published a glossary of basic terms in the field of preventive toxicology.

**Regulation of chemicals in environmental objects.** The chemical contamination of various environmental objects in terms of their qualitative composition can be very diverse, depending on the nature of its sources, features of technological processes, raw materials used, intermediate and final products obtained. The qualitative state of biomass – atmospheric air, water, soil, food

products – can change not only due to the constant involvement in industrial production of all new chemical elements, but also due to intermediate products of the hazardous substances' decomposition during their biotransformation in the environment. Biosphere pollution represents a real and potential hazard to human health.

Criteria for environmental and toxicological assessment of chemicals are based on a comprehensive study of their impact not only on the quality of the natural environment itself, but, most importantly, on the human health. These criteria shall take into account the effects of actions and interactions of chemical compounds on individual elements and links of such a complex dynamic multiparametric system as "chemicals - environment - person".

The behavior of chemicals in the environment, mechanisms of general toxic and specific effects are largely determined by the amount of material entering the environment and their resistance to atmospheric air, water, soil, plants, and food products. Importance is also given to the mobility of chemicals in the environment and their ability to accumulate in biological objects. *Bioconcentration (biocumulation)* is the ability of chemicals to accumulate in large quantities when moving in food chains.

The assessment of toxicity and hazard of chemicals in terms of ecotoxicology has its differences and features. The toxicity of chemicals for terrestrial and aquatic animals is judged mainly by the same criteria as industrial toxicology and, above all, by using acute, subacute, and chronic toxicity. At the same time, a wide variety of biochemical, physiological, and morphological methods of research are used to assess the general toxicity of chemicals and to identify the initial signs of intoxication.

Atmospheric air. Hygienic regulation of atmospheric pollution is carried out by their reflective and resorptive effects. Reflective reactions can manifest themselves in the form of smell and light sensitivity, and the resorptive action can be toxic, carcinogenic, mutagenic, embryotrophic, and gonadotropic.

The aforementioned circumstances dictate the need to establish two types of maximum permissible concentrations - the

maximum single and average daily - for chemical substances polluting the air. The first one is introduced to prevent negative reflective reactions during a short-term exposure, and the second one - to prevent toxic effects.

*MPC of atmospheric air (MPC<sub>a.a.</sub>)* is the maximum concentration of chemical substances attributed to a certain averaging time, which, if applied periodically or throughout the life of a person, has no harmful effect on people, including long-term consequences, and on the environment.

As a rule, the maximum permissible concentrations established for the working zone air according to sanitary and hygienic requirements are much greater than the maximum permissible concentrations for populated areas, including atmospheric air. This is explained by the fact that people spend only part of their day at work and there are no children and elderly people with poor responders, as well as many other categories of the population.

Drinking water and water reservoirs. The water supply for population with high-quality drinking water there has long been recognized the necessity of a toxicological evaluation of its quality, that is, the chemical composition. The main indicator for assessing the hazard of harmful substances when entering water is the subthreshold *no-observed adverse effect concentration* (NAEC, mg/l), determined by the sanitary-toxicological features when the chemical enters the body with water. Another indicator is the subthreshold *maximum no-effect dose* (MND), which is twenty times less than the corresponding concentration of the substance.

$$MND = NAEC/20$$

Considering that along with the general toxic effect on the body, many substances have specific smells and flavors, the *subthreshold organoleptic concentration* (SC<sub>ori</sub>) is determined by the perception of the substance with senses.

To establish the hazard class of a chemical in water and to develop appropriate criteria for hazard classes, it is necessary to have additional toxicometric information concerning the threshold concentration that does not affect the sanitary characteristics of water

in the water reservoir ( $TC_{san}$ ); threshold doses for long-term effects ( $TD_{lt}$ ) and threshold doses for the general toxic effect ( $TD_{gen}$ ). Table No.22 lists the hazard classes of chemicals in water, established according to the above toxicometric parameters.

**Table No. 22.** Sequence of establishment of a chemical's hazard class in water and criteria for hazard classes.

Sequence (study phase)	Assessment criteria	Hazard classes			
		Extremely hazardous	Highly hazardous	Moderately hazardous	Low hazard
1	MND/ $SC_{or1}$	–	1	1-10	10 and more
	MND/ $TC_{san}$	–	1	1-10	Same
2	MND, mg/l	0.001	0.001-0.1	0.1-10	„
3	$LD_{50}$ /MND	$10^6$	$10^6$ - $10^5$	$10^5$ - $10^4$	$10^4$ and less
4	$TD_{lt}$ / $TD_{gen}$	1	1-10	10-100	100 and more

According to modern concepts, the *hygienic MPC of a chemical substance in the water of water reservoirs* is the maximum concentration that does not directly or indirectly influence the state of health of this and subsequent generations when exposed to the human body throughout life and does not impair the hygienic conditions of water use by the population.

Hygienic standards regulate the content of pollutants only in those reservoirs that are used for domestic, drinking, and cultural purposes, including recreational water use. However, a modern life required the simultaneous coexistence of not only hygienic, but also fishery standards for the same chemical pollution of water. Fisheries standards were a logical addition to the water health legislation. The existing "Rules for the Protection of Surface Waters from Sewage Pollution" contain both MPC of harmful substances in water of water reservoirs for domestic and drinking water and cultural and domestic

water use, as well as MPC of hazardous substances for fishery reservoirs.

At the same time, the main criteria for development of the drinking water quality standard (GOST 2874-82) are: 1) water safety in epidemiological terms; 2) harmlessness of chemical composition; 3) favorable organoleptic properties. Compliance with this standard for drinking water ensures the harmlessness of water in terms of chemical composition, both for substances of natural and anthropogenic origin.

The hygienic classification of water reservoirs according to the degree of contamination (Table No. 23), developed by G.N. Krasovski (1978), plays a key role in ensuring favorable conditions for sanitation and household water use, and, consequently, for preserving the population health. The classification, proposed by Krasovski, makes it possible to estimate the actual load of pollutants on the water reservoir based on graded estimates for two types of water use for the population (MG "Methodical Guidelines for the Consideration of Projects for Maximum Permissible Discharges of Substances Entering Water Reservoirs with Wastewater" No. 2875-83M).



*Soil.* Anthropogenic impact on the ecosphere is usually accompanied not only by the soil pollution, but also by changes in its physical, chemical, and biological characteristics that cause a decrease in fertility and an increase in its danger to the health of the population, animals, and plants.

The soil can be contaminated mainly with solid and liquid waste from industrial and agricultural enterprises as well as from household waste. Chemical contamination of the soil occurs due to the use of a wide variety of pesticides, herbicides, fungicides, acaricides, and fertilizers, and in landfill sites with solid waste – due to contamination with dioxins. Pathogenic microorganisms (bacteria, viruses, fungi, etc.) that cause human and animal diseases belong to the most important polluting soil components.

The problem of hygienic regulation of chemical soil contaminants is related to the need to evaluate a chemical substance according to several harmful indices: general sanitary, water-migration, air-migration, and translocation. Migratory air harmful index characterizes the transition of substances from the arable soil layer to the atmospheric air; the translocation harmful index characterizes the transition of a chemical substance from the arable soil layer through the roots to the plant and its accumulation in the green mass, and the general health harmful index characterizes the effect of the chemical on the soil ability to self-purification and on the microflora of the soil.

The methodology of hygienic regulation of harmful chemicals in the soil is constantly being improved and requires the mandatory determination of the stability of the chemical in the soil, the threshold concentration of the chemical substance in the soil according to the general health harmful index and the water-migration harmful index. It is also necessary to determine the threshold amount of a chemical substance in the soil by the translocation and airborne migration indices, and the threshold amount of a chemical substance according to the toxicological harmful index.

MPC of a chemical substance in soil is the maximum amount of a chemical substance (in mg/kg of soil) that does not cause indirect

**Table No. 23.** Hygienic classification of water reservoirs by degree of pollution.

Pollution degree	Pollution criteria					
	Organoleptic properties		Toxicological properties	Sanitary conditions of water reservoirs		Impurity index
	Odor, aftertaste (in points)	MPC <sub>org</sub> (degree of surpassing)	MPC <sub>tox</sub> (degree of surpassing)	BOD <sub>full</sub> , mg/l	Dissolved oxygen, mg/l	
	Water use category					
	I and II	I and II	I and II	I	II	I and II
Acceptable	2	1	1	3	6	4
Moderate	3	4	3	6	8	3
High	4	8	10	8	10	2
Extremely high	>4	>8	>100	>	>10	1
				8		3

MPC<sub>org</sub> is the maximum permissible concentrations of substances, established by the organoleptic harmful index, mg/l.  
MPC<sub>tox</sub> is the maximum permissible concentrations of substances, established by the sanitary-toxicological harmful index, mg/l.

negative effects on humans through soil contacting media and does not inhibit the self-cleaning ability of the soil.

Sanitary and hygienic condition of the soil is estimated by a number of hygiene indices, including the so-called sanitary index, that is, the ratio of protein nitrogen to the total organic. In addition, the presence of *E. coli* (colitis), larvae of flies, eggs of helminths is taken into account. According to a set of these indices, the soil is estimated to be either clean or polluted (Table No.24).

**Table No. 24.** Complex hygienic indices of soil sanitary state.

Soil quality evaluation	Index name				
	Fly larvae and pupae in 0.25 v <sup>3</sup> of soil, ind.	Helminth eggs in 1 kg of soil, ind.	Coli titer	Anaerobic bacteria titer	Sanitary index
Clean	0	0	>1	>0.1	0.98-1.0
Slightly polluted	Individual	< 10	1-0.01	0.1-0.001	0.85-0.98
Polluted	10-25	11-100	0.01-0.001	0.001-0.00001	0.70-0.80
Heavily polluted	> 25	> 100	> 0.001	<0.00001	<0.70

The standards for the accumulation of industrial wastes on the enterprise territory are established on the basis of indicators, including the size of the storage area, and the toxicity and chemical activity of the compounds present in the waste. There are also formulas for calculating these values, although the principles of such rating and general approaches can vary in regions with different soils and climatic conditions. Normally, two indicators are standardized: the limiting amount of toxic industrial wastes on the enterprise territory and the maximum content of toxic compounds in the industrial waste.

Food items. Alien toxic substances in food can have both natural and artificial origin. Natural impurities are substances of geochemical origin, so-called geochemical inorganic and element-

organic substances, as well as compounds specific for individual products. Artificial foreign substances (xenobiotics) in food items can be attributed to anthropogenic impurities entering the items and deliberately introduced food additives.

To ensure the possibility of controlling the content of alien substances in various food items and diets, there should be their respective hygienic regulations. Given the very wide variety of both the chemical composition of the food items and numerous artificial and natural contaminants, the most important is the definition of toxicants, the content of which should be normalized in all the most widely consumed foods (Table No. 25).

**Table No. 25.** MPC of chemical elements in food items, mg/kg of the item (Handbook: Chemical Composition of Food Items, M., 1987, vol. 1, 2).

Element	Food items						
	fish	meats	dairy	bread	vegetables	fruit	juice
Aluminum	3.0	10.0	1.0	20.0	30.0	20.0	10.0
Iron	30.0	50.0	3.0	50.0	50.0	50.0	15.0
Iodine	2.0	1.0	0.3	1.0	1.0	1.0	1.0
Cadmium	0.1	0.05	0.01	0.022	0.03	0.03	0.002
Copper	10.0	5.0	0.5	5.0	10.0	10.0	5.0
Arsenic	1.0	0.5	0.05	0.2	0.2	0.2	0.2
Nickel	0.5	0.5	0.1	0.5	0.5	0.5	0.3
Tin	200.0	200.0	100.0	-	200.0	100.0	100.0
Mercury	0.5	0.03	0.005	0.01	0.02	0.01	0.005
Lead	1.0	0.5	0.05	0.2	0.5	0.4	0.4
Selenium	1.0	1.0	0.5	0.5	0.5	0.5	0.5
Stibium	0.5	0.1	0.05	0.1	0.3	0.3	0.2
Fluorine	10.0	2.5	2.5	2.5	2.5	2.5	2.5
Chromium	0.3	0.2	0.1	0.2	0.2	0.1	0.1
Zinc	40.0	40.0	5.0	25.0	10.0	10.0	10.0

In contrast to the practice of hygienic regulation of chemicals in the air, water and soil, for certain types of foods in many cases it is necessary to have differentiated standards for the same substances.

The number of regulations should correspond to the number of basic food items. This approach is stipulated by the difference in natural content of the same elements in food items, where the hygienic regulations for individual foods are different.

A special place among the xenobiotics, which contaminate food items, occupy pesticides. For some agricultural crops, the appropriate MPCs for pesticides and their metabolites have been established. These hygienic standards take into account physicochemical properties of pesticides, time of preservation of their residues and metabolites in the food items, specific nutritional and biological values of the food items, as well as the methods for their cooking. The hygienic regulations of pesticides allow the use of temporarily allowable concentrations of pesticides in the food items, which are derived by the calculation method.

**Preventive measures.** Preventive measures on adverse effects of industrial poisons include constructive and technological, sanitary and hygienic, and therapeutic and preventive measures. Constructive and technological and planning measures include the development and application of technologies that ensure the maximum use of raw materials, intermediate products and production wastes on the basis of a non-waste or low-waste technology; selection of building well-ventilated areas, correct interposition of emission sources and residential areas, taking into account the direction of the wind rose, and sanitary protection zones.

Sanitary and hygienic measures are not only to reduce emissions of industrial poisons into the atmosphere, but also to regulate them. Hygienic rating is aimed at the establishment and adherence to the maximum permissible concentrations of harmful chemicals not only in the working zone air and atmospheric air, but also in water, soil, and food. The main means for MPC compliance is also the establishment of standards for maximum permissible emissions for each stationary source of emissions.

In the system of recreational activities, automated and remote management of technological processes, installation of effective general exchange and local ventilation, use of collective and individual protection equipment are also important. The compilation

of a comprehensive plan of measures to combat occupational diseases is of immense importance at enterprises. Obligatory requirement is observance of a mode of work and rest, actions on the scientific organization of labor, and training of safe work methods.

Medical and preventative measures include the provision of preliminary and periodic medical examinations, early detection of certain forms of intoxication, formation of appropriate "risk groups", and subsequent rehabilitation of trained workers and patients in specialized clinics and rehabilitation centers. An important place in the system of hygienic activities is given to the timely receipt of the healthful and dietary meals by workers who are employed in harmful and dangerous industries.

### 6.2.5. Vibration

Vibration, as a factor in the operational environment, occurs in a wide variety of industries: metalworking, metallurgy, mining, oil and gas, engineering, transport, agriculture, and many other industries. Some technological processes - vibration compacting, pressing, shaping, drilling and loosening processes, transportation, others are also accompanied by the generation of various types of vibration.

*Vibration* is a small mechanical oscillation that occurs in elastic bodies under the influence of variable forces.

The most diverse equipment and devices, transport mechanisms using reciprocating moving systems (crank-connecting mechanisms, perforators, vibrating rammers, joggling machines, etc.); unbalanced rotating masses, impact interaction of mating parts (cutting tools, drills, grinding machines, process equipment, gears, bearing units); equipment and tools that use for technological purposes impact on the material being processed (chippers and jackhammers, presses, tools used in riveting, minting, etc.) are a *source of vibration*.

*The vibrational zone* is the area of vibration propagation.

**Vibration characteristics.** Vibration is characterized by speed ( $v$ , m/s) and acceleration ( $a$ , m/s<sup>2</sup>) of the oscillating solid surface. Usually these parameters are called *vibration velocity* and *vibration acceleration*.

In accordance with the laws of biomechanics, the sensation of a human arising from various external effects and, in particular, vibration, is proportional to the logarithm of the amount of stimulus energy (Weber-Fechner law). In this reaction, logarithmic values are introduced: levels of *vibration velocity* and *vibration acceleration*:

$$L_v = 10 \lg(v^2 / v_0^2) = 20 \lg(v / v_0), \quad L_a = 10 \lg(a / a_0)$$

The unit of measurement of a vibration level are decibels (dB). The internationally standardized values of  $v_0 = 5 \cdot 10^{-8}$  m/s,  $a_0 = 3 \cdot 10^{-4}$  m/s<sup>2</sup> are taken as threshold values of vibration velocity and vibration acceleration.

*Frequency of vibration (f)* is the number of oscillations per unit time. The frequency is measured in hertz (Hz, 1/s) that is the number of vibrations per second, and the frequency of operational vibrations varies in the range from 0.5 to 8000 Hz. *The period of oscillation T(c):*  $T = 1/f$  is the time during which one oscillation takes place. *The amplitude of the vibro-displacement A (m)* is the maximum distance to which any point of the vibrating body moves. The relationship between vibro-displacement, vibration velocity and acceleration is expressed by the following formulae:

$$v = 2\pi f A, \quad a = (2\pi f)^2 A,$$

where  $\pi = 3,14$ .

Vibration can be characterized by one or more frequencies (discrete spectrum) or a wide range of frequencies (continuous spectrum). The frequency spectrum is divided into frequency bands (octave bands). In the octave range, the upper boundary frequency  $f_1$  is twice the lower boundary frequency  $f_2$ , i.e.  $f_1 / f_2 = 2$ . The octave band is characterized by its average geometric frequency.

The average geometric frequencies of the vibration octave frequency bands are standardized as:

$$f_{cr} = \sqrt{f_1 f_2}$$

From the definition of the octave to the geometric mean value of its frequency, the lower and upper values of the octave band can be determined.

**Vibration classification.** Operational vibration, depending on its physical characteristics, distribution in the environment, and source of origin is classified into the following types (Figure No. 22):

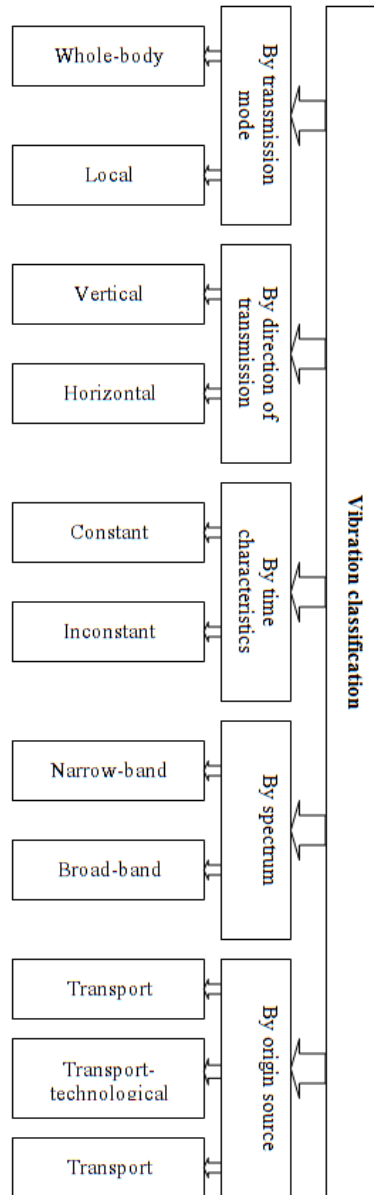


Figure № 22

By the transmission mode – whole-body and local. *Whole-body vibration* (vibration of workplaces) is transmitted through the support surfaces to the entire body of a seated or standing person. *Local vibration* (local) is transmitted to the hands or parts of the human body that come into contact with the vibrating tool or vibrating surfaces of the technological equipment.

By direction of transmission – vertical vibration (Z), acting along the orthogonal axis of the coordinate system (foot-head); horizontal vibration (X) (back-chest) and horizontal vibration (Y) (right shoulder - left shoulder).

By time characteristics - *constant* vibration (the vibration velocity magnitude varies by no more than 6 dB); *inconstant* vibrations (the value of the vibration velocity is changed by not less than 6 dB).

By spectrum – *narrow-band* (vibration levels at individual frequencies or frequency bands more than 15 dB exceed the values in neighboring bands); *broadband* (there are no pronounced frequencies or narrow frequency bands at which vibration levels exceed more than 15 dB of neighboring frequencies).

By frequency spectrum – low frequency ( $f_{cr} = 8, 16$  Hz for local vibration and 1, 4 Hz for whole-body vibration); *mid-frequency* ( $f_{cr} = 31,5, 63$  Hz for local and 8, 16 Hz for whole-body vibration); *high frequency* ( $f_{cr} = 125, 250, 500, 1000$  Hz for local and 31,5, 63 Hz – for whole-body vibration).

By origin source, the whole-body vibration is divided into 3 categories: *transport vibration* affecting a person at workplaces of vehicles during their movement on terrains (category 1); *transport-technological vibration* affecting a person at workplaces of machines with a limited movement zone when they move over specially prepared surfaces of industrial premises, industrial sites (category 2); *technological vibration* affecting a person at workplaces of stationary machines and process equipment or transmitted to workplaces that do not have sources of vibration (category 3).

**The effect of vibration on the body.** The vibration is perceived by several analyzers (cutaneous, vestibular, etc.), having different properties; therefore, the vibration sensation changes with a

change in its intensity, frequency response, duration, place, and direction of transmission, etc.

According to the latest research, the effects of vibration on a human are determined by deformation or displacement of tissues and organs, which disrupts their normal functioning and leads to irritation of numerous mechanoreceptors that perceive vibration. The consequence of this phenomenon is a change in the psychological and physiological responses of a person.

Vibration refers to factors that have great biological activity. The nature, depth and direction of physiological and pathological changes of various body systems is determined not only by the nature of the vibration effect (frequency and level of the acting vibration, duration and place of its action, direction of the vibration axis), but also by various properties of the anatomical structures of organs and tissues of the human body, as well as the peculiarities of individual sensitivity.

Under the influence of vibration on a human, the human body is a complex dynamic system, which has rhythmic fluctuations, including internal organs. Under these conditions, the coincidence of natural frequencies of human internal organs and certain parts of the body with the frequency of induced vibration, a phenomenon of resonance arises, in which the amplitude of oscillation of the body organs and parts increases sharply. As the human body is a complex oscillatory system with its own resonance, many biological effects are strictly frequency dependent.

The resonance range for the head of a seated person is in the zone between 20 and 30 Hz. In this range, the acceleration amplitude of the head can be 3 times the amplitude of the arms. It is established that the main resonance of the body of a sleeping or lying person for vibration acting in the direction of the Z axis is observed at frequencies of 4-6 Hz. For a person standing on a vibrating platform, two resonant types are distinguished at frequencies of 5-12 and 17-25 Hz.

Oscillations of internal organs in the thoracic and abdominal cavities at the standing position reveal resonance under the influence of vibration at a frequency of 3.0-3.5 Hz, but the maximum

amplitude of the abdominal wall oscillations is at frequencies from 7-8 Hz, and front chest wall - from 7-11 Hz. The frequency range from 4 to 8 Hz can be limiting for human stability and vibration due to the displacement of internal organs, especially the abdominal cavity.

The handle of the manual machine has one maximum of vibration in the region below 5 Hz and the second one - in the region of 30-40 Hz.

The mechanical system of the human hand has a resonance in the frequency range of 30-60 Hz. When transmitting vibration from the palm to the back of the hand, the amplitude of oscillations at a constant frequency of 40-50 Hz is reduced by 35-65%. The attenuation of oscillations increases from hand to elbow with a maximum effect in the shoulder joint and head.

With prolonged exposure to whole-body and local vibrations in the human body, complex morpho-functional changes occur in various organs and tissues. Primarily, central and peripheral nervous systems, and regulation of vascular tone suffer from these effects that lead ultimately to the development of vibration sickness. The factors of the operational environment, exacerbating the harmful effects of vibration on the human body, include increased muscle loads, unfavorable microclimatic conditions (primarily low temperature and high humidity), and high-intensity noise, which usually accompanies vibration and psycho-emotional tension. Cooling and wetting of hands significantly increases the risk of developing a vibrational disease due to increased vascular responses.

***Hygienic rating of vibration.*** The main normative documents regulating the maximum permissible vibration values are the following sanitary norms, rules, and standards: "Sanitary and epidemiological requirements for working conditions with vibration sources" No. 310 (2005); "Sanitary norms and rules when working with machines and equipment that create local vibration transmitted to hands of workers" No. 3041-84; GOST 12.1.012-7 "SSBT. Vibration. General safety requirements".

Hygienic rating is set separately for whole-body and local vibrations. The whole-body vibration is normalized in the octave bands with average geometric values for frequencies of 2, 4, 8, 16,

31.5, 63 Hz (for transport vibration, vibration in the octave band with  $f_{cg} = 1$  Hz is additionally normalized). Local vibration is normalized in the frequency bands with  $f_{cg} = 16, 31.5, 63, 125, 250, 500, 1000$  Hz. The norms are set for a working shift of 8 hours.

The permissible values of the vibration level for general transport, transport-technological and technological vibrations, as well as permissible values of transport and local vibrations in the octave bands are presented in Tables 26-28.

**Table No. 26.** Permissible values for transport vibration in the octave frequency (SanPiN No. 3041-84, extract).

Average geometric frequencies of octave bands, Hz	Vibration acceleration				Vibration velocity			
	m/s <sup>2</sup>		dB		m/sx10 <sup>-2</sup>		dB	
	Z	XY	Z	XY	Z	XY	Z	XY
1.0	1.10	0.40	121	112	20.0	6.3	132	122
2.0	0.8	0.45	118	113	7.1	3.5	123	117
4.0	0.56	0.79	115	118	2.5	3.2	114	116
8.0	0.63	1.60	116	124	1.3	3.2	108	116
16.0	1.10	3.20	121	130	1.1	3.2	107	116
31.5	2.20	6.30	127	136	1.1	3.2	107	116
63.0	4.50	13.0	133	142	1.1	3.2	107	116
Corrected and equivalent corrected values and their levels	0.56	0.40	115	112	1.1	3.2	107	116

**Table No. 27.** Hygienic norms of vibration (SN 2.2.4/2.1.8.556-96, extract).

Vibration type	Permissible level of vibration velocity, dB, in octave bands with mean geometric frequencies, Hz										
	1	2	4	8	16	31,5	63	125	250	500	1000
Whole-body transport											
Vertical	132	123	114	108	107	107	107	-	-	-	-
horizontal	132	117	116	116	116	116	116	-	-	-	-
Transport-technological	-	117	108	102	101	101	101	-	-	-	-
Technological	-	108	99	93	92	92	92	-	-	-	-
In operational premises with no machines generating vibration	-	100	91	85	84	84	84	-	-	-	-
In offices, health centers, design offices, laboratories	-	91	82	76	75	75	75	-	-	-	-
Local vibration	-	-	-	115	109	109	109	109	109	109	109

**Table No. 28.** The maximum permissible values of the local vibration parameters along **Z, X, Y axes** (SN 2.2.4/2.1.8.556-96, extract).

Average geometric frequencies of octave bands, Hz	Vibration acceleration		Vibration velocity	
	m/s <sup>2</sup>	dB	m/sx10 <sup>-2</sup>	dB
8	1.4	123	2.8	115
16	1.4	123	1.4	109
31.5	2.8	129	1.4	109
63	5.6	135	1.4	109
125	11.0	141	1.4	109
250	22.0	147	1.4	109
500	45.0	153	1.4	109
1000	89	159	1.4	109
Corrected and equivalent corrected values and their levels	2.0	126	20.0	112

**Preventive measures.** Actions to prevent adverse effects on the body of whole-body and local vibrations include technical, administrative, and medical preventive activities. When using vibro-hazardous hand instruments, the work should be carried out using labor regimes that must ensure: the limitation of the time of exposure to vibration and the rational distribution of work with vibro-hazardous hand tools during the working shift, the limitation of the duration of the continuous single exposure to vibration and the use of regulated breaks for rest and medical- preventive measures.

Labor routines shall include the permissible total time of contact with vibrating hand instruments, the duration and time of breaks, both regulated and in accordance with labor routines, as well as a list of jobs in which operators with hand tools can be employed during breaks.

In technical documents (passport, technical description, instruction) for equipment, instrument and apparatus, which are sources of a local vibration, it is necessary to indicate the following:

- the presence of constructive solutions that exclude or limit the adverse effects of vibration;

- vibration characteristics (values of vibration velocity and vibration acceleration) for all nominal operating modes of equipment, tools and devices measured in three directions of the orthogonal coordinate system at the points of contact with the operator's hands, noise characteristics;

- the mass of a hand tool, the weight of a hand tool intended for hands of the operator when performing various technological operations, the minimum pressing force applied by operator hands in the mode established in the passport;

- associated harmful operational factors, the sources of which are this instrument and equipment.

A set of preventive measures includes annual occupational health examinations of workers, receiving healthy diets and vitamins, resort therapy, and other activities.

Technical protection against vibration includes the following measures of active vibration protection:

- vibration isolation - reduction of transmission of oscillations from the excitation source to the protected object by means of devices placed between them (rubber, spring vibration isolators);

- vibration damping - increase of the mechanical active impedance of oscillating elements by increasing the dissipative forces at oscillations with frequencies close to resonant ones;

- dynamic damping of oscillations by attaching to a protected object of the system, the reaction of which reduces the range of vibration at the points of attachment;

- change of structural elements and building constructions.

Reducing the adverse impact of vibration on workers is implemented by reducing vibration in the source of origin, through constructive and technological solutions in the development of new machines and modernization of existing machines, equipment, and tools; reduction of vibration in the transmission path by means of vibration isolation and vibration absorption; and application of remote and automatic control. Observance of safety requirements concerning the exclusion of employees working with vibrating surfaces outside the working area (warning signs, alarms, fencing, etc.), prohibition of workers staying on the vibrating surface of the



operational equipment during its operation, planned and preventive repair of machinery and equipment contribute to reducing harmful impact of vibration on the body of leading professional groups of workers.

### 6.2.6. Noise

In the period of industrialization, modern scientific and technical progress, is characterized by increasing production capacity, emergence of new equipment with huge capacities, intensification of existing technological processes, which are accompanied by an increase in the noise load impacting workers and expansion of the range of acoustic vibrations towards ultrasound and infrasound ranges.

Most urban population in the modern environment is exposed to noise in the residential area, which is determined by the impact of a number of external noise sources. The sources of this kind include, first of all, road, rail, and air transport, a number of industrial enterprises and installations, as well as other noise impacts associated with various types of vital activity of the population. This is an internal noise effects from the operation of sanitary (water, sewage) and transport (elevators, garbage) equipment as well as from a wide variety of electrical household appliances (radio, television, video equipment, etc.).

*Noise* is an incoherent combination of sounds of varying frequency and intensity.

**Characteristics of noise.** The noise is characterized by the velocity of air particles  $v$  (m/s), the speed of sound propagation  $c$  (m/s) - the speed of sound wave propagation. Under normal atmospheric conditions (temperature - 20°C, pressure - 105 Pa), the sound velocity in air is 344 m/s.

The sound pressure  $p$  (Pa) is the difference between the instantaneous value of the total pressure and the mean pressure that is observed in the unperturbed medium.

$$p = v\rho c,$$

where  $\rho$  – medium density (kg/m<sup>3</sup>),  $\rho c$  – the specific acoustic resistance (Pa · s/m), equal to 410 Pa · s/m for air,  $1,5 \cdot 10^6$  Pa · s/m – for water,  $4,8 \cdot 10^7$  Pa · s/m – for steel.

When sound propagates with the speed of a sound wave, energy is transmitted, which is characterized by the intensity of sound.

The intensity of sound  $I$  (W/m<sup>2</sup>) is the energy transferred by a sound wave per unit time, referred to the surface area through which it propagates.

$$I = p^2 / (\rho c).$$

As for vibration, sound pressure and sound intensity are usually characterized by their logarithmic values - the *levels of sound pressure and sound intensity*.

*Sound pressure level*

$$L_p = 10 \lg(p^2 / p_0^2) = 20 \lg(p / p_0),$$

where  $p$  – sound pressure, Pa;  $p_0$  – threshold sound pressure equal to  $2 \cdot 10^{-5}$  Pa.

*Sound intensity level*

$$L_i = 10 \lg(I / I_0),$$

where  $I$  – sound intensity, Pa,  $I_0$  – threshold sound intensity equal to  $10^{-12}$  W/m<sup>2</sup>.

An important characteristic that determines the propagation of noise and its effect on a human is its frequency. As for vibration, the range of sound frequencies is divided into octave bands ( $f_1/f_2 = 2$ ), characterized by their average geometric frequencies  $f_c$ . The cut-off and mid-geometric frequencies of octave bands are given below (Table No. 29).

**Table No. 29.** Frequencies and ranges of octave bands.

Average geometric values of octave bands, Hz	Cut-off frequencies and ranges of octave bands, Hz
63	45...90
125	90...180
250	180...355
500	355...710
1000	710...1400
2000	1400...2800
4000	2800...5600
8000	5600...11200

The range of sound pressure perceived by human ears is very large, from the barely discernible (threshold of audibility) to the values causing unpleasant pain sensations (threshold of pain sensations). To assess the level of sound (noise) is not using physical characteristics (pressure, energy), but relative values based on the subjective auditory perception of sounds. This value is currently a unit of Bel (B) – a degree of the logarithmic scale. However, for practical purposes, units of Bel are replaced with units 10 times smaller, called decibels (dB).

The human ear perceives mechanical vibrations (noise) with frequencies from 20 to 20 000 Hz. With age, this range narrows, especially by lowering the audibility of high tones, to frequencies of 12,000 Hz. The ultrasonic range is over 20,000 Hz (20 kHz), infrasound is less than 20 Hz. The sensitivity of the human hearing aid is greatest in the range 2000-5000 Hz. The reference sound is a sound with a frequency of 1000 Hz.

As threshold values, the minimum values of sound pressure and sound intensity that a person hears at a sound frequency of 1000 Hz are accepted, and therefore, they were given the names of *audibility thresholds*. Table No. 30 shows comparative values of sound intensity from different sources - from the lowest to the most intense, accompanied by a pain threshold.

**Table No. 30.** Characteristics of the sound perception by the human's organ of hearing.

Sound pressure level, dB	Noise source
0	Total silence
10	Plapitation of leaves
35 - 40	Silent conversation, quiet music
60 - 70	Loud speech
75 - 80	Loud music, busy traffic
100 - 120	Jet engine
130 - 140	Pain threshold

**Classification of industrial noise.** The noise is classified by frequency, spectral and temporal characteristics, and nature of its occurrence (see Figure No. 23).

Using frequency, acoustic oscillations differ by *infrasound* ( $f < 20$  Hz), *sound* ( $20 \leq f \leq 20,000$  Hz), and *ultrasound* ( $f > 20,000$  Hz). Acoustic vibrations of the sound range (perceived by the human hearing organ) are divided into *low frequency* (less than 350 Hz), *medium frequency* (from 350 to 800 Hz), and *high frequency* (over 800 Hz).

According to the spectral characteristics, *broadband* with a continuous spectrum of more than one octave and *tonal (discrete)*, in the spectrum of which pronounced discrete tones (frequencies where the sound level is much higher than the sound level at other frequencies) are recognized.

According to the time characteristics, *constant* (noise is considered constant, the level of which changes by no more than 5 dB during an 8-hour working day) and *inconstant* (unstable if this change exceeds 5 dB). Unstable noise, in turn, is divided into *oscillating*, the sound level of which varies continuously in time; *intermittent*, the sound level of which varies stepwise (by 5 dB or more), and the duration of intervals in which the sound level remains constant for at least 1 s; *pulsed*, which are sound pulses, lasting less than 1 s.

By the source of occurrence - *mechanical*, *aerodynamic*, *hydraulic*, *electromagnetic*.

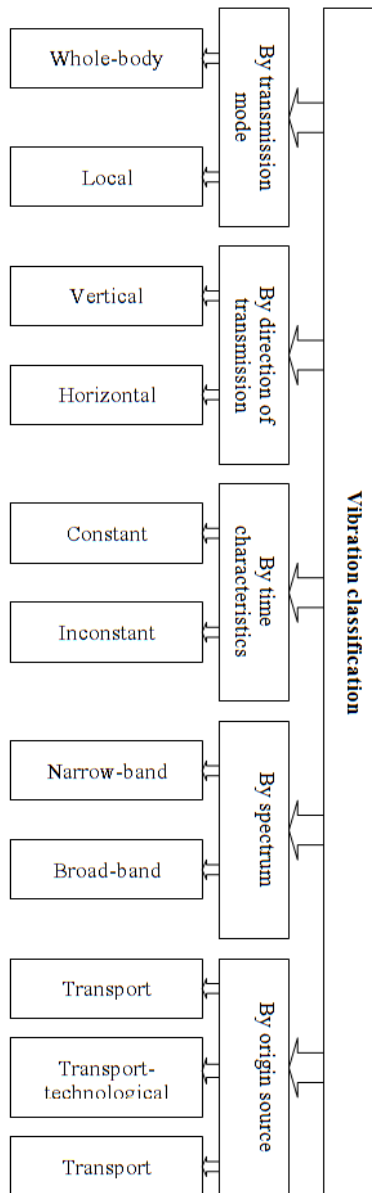


Figure № 22

As a type of acoustic vibrations, noise is subject to the physical laws of mechanical vibrations in elastic media. The energy from the oscillation source is transmitted to particles of the medium. As the acoustic wave propagates, particles of the medium are involved in the vibrational motion with a frequency equal to the frequency of the oscillation source and with a phase delay that depends on the distance to the source and on the wave propagation velocity. The propagation velocity of the acoustic wave depends not only on the density of the medium in which it propagates, but also on the distance from the wave source, length of the wave, and other factors. Propagating in space, sound vibrations create an acoustic field in which such physical phenomena as refraction, diffraction, and reflection are found.

Knowledge of acoustic phenomena, that arise when sound waves propagate, are important for the characteristics of the noise factor, its hygienic evaluation, and the choice of protection measures.

*Interference* is the phenomenon of the imposition of sound waves of the same frequency at a particular point in space simultaneously in one phase or in an antiphase, which determines the amplification or attenuation of sound.

*Diffraction* is the process of enveloping the sound wave of obstacles of finite dimensions.

*Reverberation* is the process of propagation of a sound wave in enclosed space, accompanied by the formation of a sound field due to the multiple reflection of the sound wave from the surface of the overlapping and creating conditions for the appearance of room noise.

*Resonance* is the increase in the amplitude of oscillations of elastic and inertial forces of the system that arise as a result of stratification of oscillations of the external medium with natural oscillations of the system.

***The effect of noise on the body.*** Noise refers to those unfavorable factors of the working environment, to which one cannot be accustomed. Biologically, noise is a strong stress factor that causes significant changes in the central and peripheral nervous

system, cardiovascular system, neuroendocrine regulation, and functioning of the gastrointestinal tract. Industrial and domestic noise (intra-microdistrict, intra-house) can disturb not only professional activity, but also rest, sleep, interfere with speech communication, damage the hearing and cause other pathological reactions in the human body.

The noise factor leads to the development of specific and nonspecific changes in the human body, the depth of which depends on the intensity and duration of exposure to acoustic vibrations. "Noise sickness", which is a common body disease, with the predominant defeat of its leading systems, is characterized by the gradual development of pathological processes, beginning with nonspecific manifestations and ending with the development of specific changes in the hearing organ.

Specific harmful effect of noise is associated with the development of professional hearing loss. The main symptoms of professional hearing loss are a gradual loss of hearing on both ears, an initial hearing loss in the 4000-Hz zone with subsequent spreading to lower frequencies that determine the ability to perceive speech. Morphofunctional features of occupational deafness comprise the degenerative changes in organs of Corti and spiral ganglion. Additional signs of deafness can include other symptoms: ringing and noise in the head, hyperemia of the tympanic membrane, its retraction, etc.

According to the ISO-1999 standard, the risk of hearing loss during 10 years of noise exposure for workers is 10% at a noise level of 90 dB (A); 29% - at 100 dB (A), and 55% - at 110 dB (A). In the development of occupational deafness, the total time of exposure to noise during the working day and the presence of pauses, as well as the total length of service, are important. The initial stage of professional defeat is most often observed in workers with experience of 5 years, pronounced forms of professional hearing loss (hearing loss at all frequencies, impaired perception of whisper and spoken language) with work experience of over 10 years.

There is a relationship between the incidence and length of stay in a noisy environment. Thus, the growth of general somatic

pathology in an urbanized city is observed after living for 8-10 years, when exposed to noise with an intensity above 70 dB. In the structure of morbidity, the leading places are occupied by diseases of the cardiovascular system (hypertensive disease, ischemic heart disease) and asthenovegetative syndrome. People exposed to noise have changes in the secretory and motor function of the gastrointestinal tract and shifts in metabolic processes. Under the influence of noise, attention is weakened, physical and mental efficiency is reduced.

**Hygienic rating of noise.** To prevent the adverse effect of noise on human health, the hygienic standards of permissible levels of its impact are of paramount importance. Specific methods for measuring the noise load, measures to limit and reduce the adverse impact of noise and its normalization are given in the following regulatory legal acts: SR "On measures to reduce the negative impact of physical factors on public health" Decree of the Chief State Sanitary Doctor MH RK No. 12 of 06.11.2003; MG "Methodological instructions for the hygienic assessment of industrial and non-industrial noise load" MH RK No. 1.02.008/u-94; GOST "SSBT. Noise, general safety requirements" No. 12.1.003-83; GN "Hygienic standards of noise levels at workplaces" No. 139 of March 24, 2005.

The *noise band* is normalized by using two methods: by the limiting spectrum of the sound level (for constant noise) and by dBA (for inconstant noise).

For constant noise, the MPL of sound pressure is set in nine octave bands with the average geometric values of the frequencies 63, 125, 250, 500, 1000, 2000, 4000, 8000 Hz (Table No. 31).

Normalization of inconstant noise (except pulsed noise) is performed in those cases when the spectrum of real noise in the workplace is unknown. The standard parameter in this case is the equivalent (in terms of energy) level of sound of broadband constant noise, which has the same effect on humans as real inconstant noise, measured on A scale of the sound level meter. The noise meters have a special A scale. When measured on A scale, the sensitivity of the sound level meter simulates the ear sensitivity curve of a human. The sound level, determined on A scale, has a special designation  $L_A$  and the unit of measurement is dBA that is used to estimate the noise

level. The sound level in dBA is related to the limiting spectrum by the following dependence:

$$L_A = LS + 5.$$

The permissible sound pressure levels depend on the frequency of sound and the type of work performed at the workplace. Higher frequencies are more unpleasant for humans; therefore, the higher the frequency, the lower the permissible sound pressure level. The higher requirements for attention and mental stress in the work performance, the lower the permissible levels of sound pressure.

**Table No. 31.** Permissible sound pressure levels, sound levels and equivalent sound levels at workplaces (SSBT Noise, general safety requirements No. 12.1.003-83, GN # 139 of 24.03.2005, extract).

No.	Work type	Sound pressure levels in dB in octave bands with mean geometric frequencies, Hz										Sound levels and equivalent sound levels, dB
	Workplace	31.5	63	125	250	500	1000	2000	4000	8000		
3	Work performed with frequently received instructions and acoustic signals' work that requires constant auditory control, etc.	96	83	74	68	63	60	57	55	54	65	
4	Work that requires concentration; work with increased requirements to the processes of monitoring and remote control of production cycles, work at consoles, etc.	103	91	83	77	73	70	68	66	64	75	
5	Performing all types of work on permanent workplaces in operational premises	107	95	87	82	78	75	73	71	69	80	
14	Workplaces of drivers and maintenance personnel of trucks	100	87	79	72	68	65	63	61	59	70	
15	Workplaces of drivers and attendants (passengers) of cars and buses	100	87	79	72	68	65	63	61	59	70	

Sanitary legislation also provides maximum permissible levels and equivalent levels of sound at workplaces, taking into account the category of severity and labor intensity. Quantitative assessment of the severity and intensity of the labor process is carried out in accordance with Guideline 2.013-94 "Hygienic criteria for assessing working conditions by hazard indices and the harmful

factors of the working environment, severity, intensity of the labor process."

**Table No. 32.** Maximum permissible sound levels and equivalent sound levels for labor activity in different categories of severity and strength of dBA (SSBT, Noise, general safety requirements No. 12.1.003-83, GN # 139 of 24.03.2005, extract).

The intensity category of the labor process	Severity categories of the labor process				
	Low physical activity	Medium physical activity	High physical activity I	High physical activity II	High physical activity III
Low	80	80	75	75	75
Medium	70	70	65	65	65
High I	60	60	-	-	-
High II	50	50	-	-	-

Based on the indices in this table, the results of noise level measurements and analysis of received data, it is possible to establish a class of working conditions under the influence of noise on workers. Within the framework of preventive and current sanitary supervision measures to improve working conditions, the approved hygienic standards regulating the maximum permissible sound pressure levels at workplaces are of considerable importance (Table No. 33).

**Table No. 33.** Maximum permissible sound pressure levels at workplaces

Sound pressure levels, dB, in octave bands with mean geometric frequencies					Total sound pressure level
2	4	8	16	31.5	
105	105	105	105	102	110

If the noise is tonal or pulsed, the acceptable levels should be taken 5 dB lower than the values specified in the relevant regulatory documents.

**Infrasound.** At present, infrasound is becoming one of the important sanitary and hygienic factors that pose a potential danger not only to workers in industrial enterprises and transport, but also to the public. In modern manufacturing and transport industries, infrasound sources are turbines, compressors, air conditioners, industrial fans, heavy machines with rotating parts, and vehicle engines.

According to the spectrum, infrasound noise is divided into *broadband* (frequency spectrum contains one or more octave infrasound band) and *tonal* (the frequency spectrum contains one of the components exceeding the levels in all other frequency bands by 10 dB and more), and by time parameters the infrasound is divided into *constant* (the level of sound pressure during observation for 1 minute changes by no more than 10 dB) and *inconstant* (the level of sound pressure during observation for 1 minute changes by more than 10 dB).

Infrasound oscillations follow the same laws as sound, but low frequency of oscillations gives them some features. These are primarily low frequencies and large long waves, which cause a weak absorption of infrasonic waves and their relatively easy propagation over considerable distances. Due to the large wavelength, infrasound is characterized by diffraction (bending around obstacles), that enables an easy penetration into premises and bypass of barriers, which are an obstacle to audible sound. Infrasound is characterized by amplification in small premises without its own sources of noise, with closed doors and windows and even at certain points in the premises.

Infrasound is characterized by the same physical parameters as sound. Infrasound pressure is expressed in Newtons per square meter ( $N/m^2$ ); the unit of measurement of infrasound intensity is Watt per square meter ( $W/m^2$ ); frequency of oscillations of infrasound is expressed in Hertz (Hz); the level of infrasound intensity is recorded in decibels (dB).

The study of the biological and physiological effects of infrasound on the human body is quite a difficult task, because in practical life it is difficult to establish the boundaries between the effect of infrasound and audible sound. Despite the poor knowledge of the mechanisms of infrasound on the body, there are literature data that indicate that infrasonic waves have a pronounced adverse effect on the psycho-emotional sphere and work capacity, cardiovascular, endocrine and other systems, as well as the vestibular apparatus.

MPL of infrasound pressure on the workers is distinguished for different types of work. The total sound pressure level for works of different severity should not exceed 100 dB, for works of varying degrees of intellectual and emotional intensity - not more than 95 dB (SN 2.2.4/1.8.583-96).

**Ultrasound.** The ability of ultrasonic vibrations to be absorbed by the medium enabled the use of this property in various kinds of equipment and devices (generators, acoustic transducers, physiotherapeutic devices and many others) that are widely used in industry and technology (flaw detection and structural analysis of matter, determination of physic-chemical properties of materials). Ultrasound is widely used in medicine for diagnosis and treatment of a wide variety of diseases: spine, joints, peripheral nervous system, as well as for performing surgical operations.

From the hygienic standpoint, among the variety of ultrasound use methods, there are two main ones: 1) the use of low-frequency ultrasound (up to 100 kHz), propagating by contact and air; 2) the application of high-frequency ultrasound (100 kHz - 100 MHz), which is propagated exclusively by contact. The ability of ultrasound to expose a biological effect on human organs and tissues depends on the intensity, frequency and duration of ultrasound exposure.

When ultrasound affects humans, a number of consequences occur in organs and tissues: mechanical action, thermal action (due to heat generation, ultrasonic energy absorption by tissues), and physicochemical effect (due to the oxidizing and catalytic effect of ultrasound with increasing transmembrane transfer). In this case, the action of the ultrasonic field of low intensity has a stimulating and

activating effect on tissue and cellular metabolism. On the other hand, the influence of ultrasound fields of medium and high intensity suppresses metabolic processes in the body with a violation of the morphofunctional structure of organs and tissues.

Ultrasound, acting by contact, used in industry, biology and medicine, is divided by intensity into low intensity - up to 1.5 W/cm<sup>2</sup>, medium intensity - 1.5-3.0 W/cm<sup>2</sup> and high intensity 3-10 W/cm<sup>2</sup>.

The systematic influence of intensive low-frequency ultrasound exceeding hygienic standards can lead to significant functional changes in the central and peripheral nervous system, cardiovascular system, auditory and vestibular analyzer, and neuroendocrine disorders in the body. These changes are similar to those that can occur when exposed to high-frequency noise. The latter, in combination with intense ultrasound, has a pronounced effect on the response of the vestibular analyzer and, accordingly, a violation of the vestibular function.

People working with sources of contact ultrasound often complain of increased hand sensitivity to cold, paresthesia and a feeling of weakness in the hands and pain at night. In this case, headaches, dizziness, noise in ears and head, general weakness, palpitations and pain in the heart area also occur. With the progression of disorders under the influence of contact ultrasound, along with the lesion of the peripheral neurovascular apparatus of hands, osteoporotic and osteosclerotic changes in the phalanges of brushes are observed. Vegetative-sensory polyneuropathy of hands can often develop.

For ultrasound propagating by air, the permissible sound pressure levels (SPL) are set for the frequency range of 12.5 ... 100 kHz. MPL of sound pressure varies from 80 dB for a frequency of 12.5 kHz to 110 dB for the frequency range of 31.5 ... 100 kHz (Table No. 34).

For contact ultrasound, the ultrasound levels in contact areas of hands and other parts of the body should not exceed 110 dB.

When workers are exposed to the combined effect of air and contact ultrasound, the permissible levels of contact ultrasound should be reduced by 5 dB.

**Table No. 34.** Permissible levels of ultrasound at workplaces (GOST 12.1.001-89, extract).

Average geometric frequencies of one-third octave bands, kHz	Sound pressure levels, dB
12.5	80
16.0	90
20.0	100
25.0	105
31.5-100	110

**Preventive measures.** Control of adverse effects of noise, infra- and ultrasound includes a whole range of activities related to technical and medical framework:

- elimination of the cause of noise, infra- and ultrasound or significant weakening in the source of origin;
- isolation of the source of noise, infra- and ultrasound from the environment by means of soundproofing and sound absorption;
- reduction of the sound energy density of the premises reflected from walls and ceilings, as well as rational layout of premises and shops;
- application of individual and collective protection against noise, infra- and ultrasound;
- rationalization of routines of work and rest, the use of a set of preventive measures of a medical nature.

When organizing technological processes that form noise, infra- and ultrasound, it is necessary to provide the use of tools and methods that reduce their levels, both in their source of origin and along the path of their propagation, through the following activities: application of low-noise technological processes, machinery and equipment; application of remote control and automatic control; application of soundproof enclosures-casings, booths for monitoring the progress of the technological process; installation of sound-

absorbing facings, use of vibration absorption and vibration isolation; installation of a wide variety of silencers of the aerodynamic type; rational architectural and planning solutions, building of industrial constructions, premises, arrangement of technological equipment, machines, and layouts of workplaces.

Measures to prevent the effects of noise, infra- and ultrasound on the human body in populated areas also provide a complex of technical, architectural and planning and administrative actions aimed at creating a noise regime that meets hygienic requirements in the urban environment. Among these measures, the importance of building houses with a special architectural and planning structure and a volumetric-spatial solution (the location of public rooms from the side of the noise source – traffic artery, and, accordingly, bedrooms - from the side of the yard) is of great importance; creation of noise protection strips of gardening, the use of building materials with increased sound-proof and sound-absorbing properties, as well as the construction of window openings with increased sound insulation.

A complex of technical, architectural, and planning activities to control noise, infra- and ultrasound includes medical means of prevention, the most important of which are preliminary and periodic occupational health examinations. Therefore, contraindications for employment, accompanied by noise, infra-and ultrasound, are persistent hearing loss of any etiology, otosclerosis, and other chronic ear diseases, violation of the vestibular apparatus of any etiology, and Meniere's disease. In addition, measures aimed at increasing the body's resistance to noise, infra-and ultrasound (rational nutrition and vitamin addition, psychophysiological stress relief, industrial gymnastics, adherence to a healthy lifestyle) are also important.

### **6.2.7. Electromagnetic fields**

Sources of electromagnetic fields (EMF) are extremely diverse: these are electric power transmission and distribution systems (electric power transmission lines, transformer and

distribution substations) and appliances that consume electricity (electric motors, electric cookers, electric heaters, refrigerators, TV sets, video-display terminals, etc.). The sources generating and transmitting electromagnetic energy include radio and television broadcasting stations, radar installations and radio communication systems, a wide variety of technological installations in the industry, medical devices and equipment (devices for diathermy and inductothermy, ultrahigh frequency treatment therapy, microwave therapy devices and others).

The working community and population may be exposed to an isolated electrical or magnetic component of the field or a combination thereof. Depending on the ratio of an irradiated person to a source of exposure, it is customary to distinguish between several types of irradiation – occupational, non-occupational, and domestic and irradiation performed for medicinal purposes. The occupational irradiation is characterized by a variety of oscillation modes and variants of electromagnetic fields' exposure (near-field irradiation, in the induction zone, general and local irradiation combined with the action of other unfavorable factors of the production environment). In the conditions of non-occupational irradiation, the most common is total irradiation, in most cases in the wave zone.

Electromagnetic fields generated by one or another source can affect the entire body of a working person (total irradiation) or a separate part of the body (local irradiation). In this case, the irradiation may be of isolated (from one EMF source) combined (from two or more EMF sources of one frequency range), mixed (from two or more EMF sources of different frequency ranges) and combined nature (under conditions of simultaneous impact of EMF and other unfavorable physical factors of the production environment).

*Electromagnetic wave* is an oscillatory process associated with changing in space and time interconnected electric and magnetic fields.

*Electromagnetic field* is an area of electromagnetic wave propagation.



**Characteristic of electromagnetic waves.** The electromagnetic field is characterized by a radiation frequency  $f$  measured in hertz, or a wavelength  $\lambda$  measured in meters. The electromagnetic wave propagates in vacuum with the speed of light ( $3 \cdot 10^8$  m/s), and the connection between the length and frequency of the electromagnetic wave is determined by the dependence

$$f = c/\lambda,$$

where  $c$  – the speed of light.

The speed of propagation of waves in air is close to the speed of their propagation in vacuum.

The electromagnetic field has energy, and the electromagnetic wave propagating in space transports this energy. The electromagnetic field has electrical and magnetic components (Table No.35).

*Electric field strength  $E$*  is a characteristic of the electrical component of the EMF, the unit of measurement of which is V/m.

*Magnetic field strength  $H$  (A/m)* is a characteristic of the magnetic component of the EMF.

*Energy flux density (EFD)* is an electromagnetic wave energy transported by the electromagnetic wave per unit time through a unit area. The unit of measurement of EFD is W/m<sup>2</sup>.

**Table No. 35.** Units of measurement of EMF in the International System of Units (SI)

Range	Unit name	Unit designation
Constant magnetic field	Magnetic induction Field strength	Ampere per meter, A/m Tesla, T
Constant electric (electrostatic) field	Field strength Potential Electric charge	Volt per meter, V/m Coulomb, C Ampere per meter, A/m
Electromagnetic field up to 300 MHz	Magnetic field strength Electric field strength	Ampere per meter, A/m Volt per meter, V/m
Electromagnetic field up to 0.3-300 GHz	Energy flux density	Watt per square meter, W/m <sup>2</sup>

For certain ranges of electromagnetic radiation - EMR (light range, laser radiation) other characteristics are introduced.

**Classification of electromagnetic fields.** The frequency range and length of an electromagnetic wave allows to classify the electromagnetic field into *a visible light (light waves), infrared (thermal) and ultraviolet radiation*, the physical basis of which is formed by electromagnetic waves. These types of short-wave radiation have a specific effect on humans.

The physical basis of *ionizing radiation* is also formed by electromagnetic waves of very high frequencies, which have a high energy sufficient to ionize the molecules of matter in which the wave propagates (Table No.36).

The radio frequency range of the electromagnetic spectrum is divided into four frequency ranges: *low frequencies (LW)* - less than 30 kHz, *high frequencies (HF)* - 30 kHz ... 30 MHz, *ultrahigh frequencies (UHF)* - 30 ... 300 MHz, *super-high frequencies (SHF)* - 300 MHz ... 750 GHz.

A special type of electromagnetic radiation (EMR) is *laser radiation (LR)* generated in the wavelength range of 0.1 ... 1000  $\mu$ m. A characteristic feature of LR is its monochromaticity (strictly one wavelength), coherence (all radiation sources emit waves in one phase), sharp beam directionality (small beam divergence).

Nominally electrostatic fields (ESF) and magnetic fields (MF) may be assigned to non-ionizing radiations (fields).

*Electrostatic field* is a field of stationary electric charges, which interacts between them.

*Static electricity* is a set of phenomena associated with the generation, conservation and relaxation of a free electric charge on the surface or in the volume of dielectrics or on insulated conductors.

*Magnetic field* can be constant, pulsed and variable.

Depending on the sources of generation, electrostatic fields can exist in the form of an electrostatic field itself generated in various types of power plants and during electrical processes. In industry, ESFs are widely used for electric and gas cleaning, electrostatic separation of ores and materials, electrostatic application of paints and lacquers and polymer materials. Manufacture, testing,

transportation and storage of semiconductor devices and integrated circuits, grinding and polishing of the cases of radio and television receivers, technological processes associated with the use of dielectric materials, as well as the premises of computation centers where multiple computing equipment is concentrated are characterized by the generation of electrostatic fields. Electrostatic charges and electrostatic fields created by them can generate in the process of movement of dielectric liquids and some bulk materials through pipelines, transfusion of dielectric liquids, rolling of film or paper. Depending on the sources of generation, electrostatic fields can exist in the form of an electrostatic field itself generated in various types of power plants and during electrical processes. In industry, ESFs are widely used for electric and gas cleaning, electrostatic separation of ores and materials, electrostatic application of paints and lacquers and polymer materials. Manufacture, testing, transportation and storage of semiconductor devices and integrated circuits, grinding and polishing of the cases of radio and television receivers, technological processes associated with the use of dielectric materials, as well as the premises of computation centers where multiple computing equipment is concentrated are characterized by the generation of electrostatic fields. Electrostatic charges and electrostatic fields created by them can generate in the process of movement of dielectric liquids and some bulk materials through pipelines, transfusion of dielectric liquids, rolling of film or paper.

**Table No. 36.** International classification of electromagnetic waves

Range No.	Range name by frequency	Metric subdivision of wavelengths	Wavelength	Abbreviated letter designation
1	3-30 Hz	Decamegаметric	100-10 mm	Extremely low, ELF
2	30-300 Hz	Megаметric	10-1 mm	Ultralow, ULF
3	0,3-3 kHz	Hectokilometric	1000-100 km	Infralow, ILF
4	from 3 to 30 kHz	Myriametric	100-10 km	Very low, VLF
5	from 30 to 300 kHz	Kilometric	10-1 km	Low, LF
6	from 300 to 3000 kHz	Hectometer	1-0,1 km	Medium, MG
7	from 3 to 30 MHz	Decametric	100-10 m	High, HF
8	from 30 to 300 MHz	Metric	10-1 m	Very high, VHF
9	from 300 to 3000 MHz	Decimetric	1-0,1 m	Ultrahigh, UHF
10	from 3 to 30 GHz	Centimetric	10-1 cm	Super-high, SHF
11	from 30 to 300 GHz	Millimetric	10-1 cm	Extremely high, EHF
12	from 300 to 3000 GHz	Decimillimetric	1-0,1 cm	Hyperhigh, HHF

Electromagnets, solenoids, capacitor type installations, cast and ceramic magnets are accompanied by the emergence of *magnetic fields*.

Three zones are distinguished in electromagnetic fields, which are formed at different distances from the source of electromagnetic radiation.

*Induction zone (near-field zone)* covers the interval from a radiation source to a distance equal to approximately  $\lambda/2\pi \approx \lambda/6$ . In this zone, the electromagnetic wave is not yet formed and therefore

the electric and magnetic fields are not interconnected and act independently (the first zone).

*Interference zone (intermediate zone)* is located at distances from about  $\lambda/2\pi$  to  $2\pi\lambda$ . In this zone an EMW is formed and the electric and magnetic fields have an effect on humans, including energy deposition (the second zone).

*Wave zone (far-field zone)* is located at distances greater than  $2\pi\lambda$ . In this zone, an electromagnetic wave is formed and electric and magnetic fields are interconnected. Human in this zone is affected by the energy of the wave (the third zone).

***Effect of the electromagnetic field on the human organism.***

The biological and pathophysiological effect of electromagnetic fields on the organism depends on the frequency range, intensity of the influencing factor, irradiation duration, nature of the radiation and the irradiation regime. The effect of EMF on the organism depends on the pattern of propagation of radio waves in material media, where the absorption of the energy of an electromagnetic wave is determined by the frequency of electromagnetic oscillations, electrical and magnetic properties of the medium.

As is known, the leading index characterizing the electrical properties of body tissues is their dielectric and magnetic permeability. In their turn, the differences in the electrical properties of tissues (dielectric and magnetic permeability, resistivity) are related to the content of free and bound water in them. All biological tissues, in terms of dielectric permeability, are divided into two groups: tissues having a high water content - over 80% (blood, muscles, skin, brain tissue, liver tissue and spleen tissue) and tissues having a relatively low water content (fatty tissue, bone). The absorption factor in tissues having high water content, with the same field strength values, is 60 times higher than in tissues having low water content. Therefore, the depth of penetration of electromagnetic waves to tissues having low water content is 10 times greater than to tissues having a high content of it.

The thermic and athermic effects underlie the mechanisms of the biological effect of electromagnetic waves. Thermal effect of EMF is characterized by selective heating of individual organs and

tissues, and increase of the overall body temperature. Intensive irradiation by EMF can cause destructive changes in tissues and organs, but acute forms of lesion are extremely rare and their occurrence is most often associated with emergency situations when occupational safety rules are violated.

Chronic forms of radio wave lesions, their symptoms and course do not have strictly specific expressions. Nevertheless, they are characterized by the development of asthenic conditions and vegetative disorders, mainly in the cardiovascular system. Along with the general asthenization accompanied by weakness, increased fatigability, troubled sleep, patients start having a headache, dizziness, psychoemotional lability, heartache, increased sweatiness and decreased appetite. There are signs of acrocyanosis, regional hyperhidrosis, coldness of hands and feet, tremor of fingers, lability of the pulse and arterial pressure with a tendency to bradycardia and hypotension; dysfunction in the pituitary-adrenocortical axis system leads to changes in the secretion of hormones of the thyroid and sexual glands.

One of the few specific lesions caused by exposure to electromagnetic radiation of the radio frequency range is a cataract development. In addition to the cataract, when exposed to high-frequency electromagnetic waves, keratitis and corneal stroma lesions can develop.

Infrared (thermal) radiation, light radiation at high energies, as well as high-level ultraviolet radiation, with the acute exposure, can lead to the dilation of capillaries, burns of skin and visual organs. Chronic irradiation is accompanied by a change in skin pigmentation, development of chronic conjunctivitis and clouding of an eye lens. Ultraviolet radiation of small levels is useful and necessary for humans, since it enhances the metabolic processes in the body and synthesis of the biologically active form of vitamin D.

The effect of laser radiation on a human depends on the radiation intensity, wavelength, radiation nature and time of exposure. At the same time, local and general damage to certain tissues of the human body is distinguished. Eye is a target organ, which is easily damaged, transparency of the cornea and lens is

broken, and retina damage is possible. Laser study, especially of the infrared range, is able to penetrate through the tissues to a significant depth, affecting internal organs. Long-term exposure to laser radiation even of small intensity can lead to various functional disorders of the nervous and cardiovascular systems, glands of internal secretion, arterial pressure, increased fatigability and performance decrement.

**Setting of environmental standards for electromagnetic fields.** According to the normative documents: SanPiN "Sanitary and epidemiological requirements to the operation of radio electronic facilities under operating conditions with electromagnetic radiation sources" No. 225 dated 10.04.2007 of the Ministry of Health of RK; SanPiN "Sanitary rules and standards for protection of the population against the influence of electromagnetic fields created by radio technical objects" No. 3.01.002-96 of the Ministry of Health of RK; "Methodological instructions for the performance of state sanitary supervision over objects having sources of electromagnetic fields (EMF) of the non-ionizing part of the spectrum" No.1.02.018/y-94 of the Ministry of Health of RK; "Methodological recommendations for conducting laboratory control of sources of electromagnetic fields of the non-ionizing part of the spectrum (EMF) while performing state sanitary supervision" No. 1.02.019/p-94 of the Ministry of Health of the Republic of Kazakhstan regulate the intensity of electromagnetic fields of radio frequencies at personnel workplaces who work with EMF sources, requirements to monitoring, and irradiation by an electric field, both in terms of intensity and duration of the effect.

The frequency range of electromagnetic field radio frequencies (60 kHz - 300 MHz) is estimated by the strength of the electric and magnetic components of the field; in the frequency range of 300 MHz - 300 GHz - by the surface density of the radiation energy flux and the energy load created by it (EL). The total energy flux passing through an irradiated surface unit during the effect time (T) and expressed by the product of the *energy flux density-time* is the energy load.

At the personnel workplaces, EMF strength in the frequency range of 60 kHz to 300 MHz during a working day shall not exceed the established maximum permissible levels (MPL):

<p><i>for the electric component, V/m:</i>            50 – for frequencies from 60 kHz to 3 MHz;            20 – for frequencies from 3 MHz to 30 MHz;            10 – for frequencies from 30 MHz to 50 MHz;            5 – for frequencies from 50 MHz to 300 MHz</p> <p>GOST 12.1.045-84; GOST 12.1.006-84            extractions</p>	<p><i>for the magnetic component, A/m:</i>            5 – for frequencies from 60 kHz to 1,5 MHz;            0,3 – for frequencies from 30 MHz to 50 MHz</p> <p>SanPiN 2.2.24.1191-03            extraction</p>
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In cases where the time of exposure of EMF to personnel does not exceed 50% of the working time, levels exceeding the indicated ones are allowed, but no more than twice.

Standardization and hygienic assessment of constant magnetic fields (CMF) in production premises and workplaces (Table No.37) is performed on a differentiated basis, depending on the time of exposure to a worker during a work shift and taking into account the conditions of general or local irradiation.

**Table No. 37.** MPLs of CMF exposure to working staff (SanPiN 2.2.24.1191-03, extraction).

Time of exposure per working day, min	Exposure conditions			
	Total (whole body)		Local (limited by wrists, scapular waist)	
	MPL of strength, kA/m	MPL of magnetic induction, mT	MPL of strength, kA/m	MPL of magnetic induction, mT
61-148	8	10	8	10
11-60	16	20	24	30
0-10	24	30	40	50

Hygienic CMF standards are also widely used (Table No.38), which are developed by the International Committee on Non-Ionizing Radiation, which carries out activities under the International Radiation Protection Association.

**Table No. 38.** MPLs of constant magnetic fields (international recommendations).

Exposure nature	MPL, T
Professionals	
- full working day	0,2
- ultimate level of short-term exposure to the body	2,0
- ultimate level of short-term exposure to the hands	5,0
Population:	
- continuous exposition	0,01

Numerous calculations show that at any point of an electromagnetic field emerged in industrial frequency electrical installations the magnetic field strength is much less than the electric field strength. The harmful effect of the magnetic field on a human is established only at field strengths above 80 A/m for periodic

magnetic fields. In connection therewith, for most EMFs of industrial frequency, the harmful effect is mainly due to the action of the electric field. For EMFs of industrial frequency (50 Hz) the maximum permissible levels of electric field strength are established. The permissible time of presence of personnel servicing industrial frequency installations is determined by the following formula

$$T = \frac{50}{E} - 2$$

where  $T$  – permissible time of presence in a zone with electric field strength  $E$  in hours;  $E$  is the electric field strength in kV/m.

The permissible duration of a person's presence during a day in an electric field (per minute) at an electric field strength of 5 kV/m is unlimited, 10 kV/m - 180 minutes, 15 kV/m - 90 minutes, 20 kV / m - 10 minutes, 25 kV/m - 5 minutes. These standards are valid provided that the rest of the working day the person is in places where the electric field strength is less than or equal to 5 kV/m and the possibility of electric charge effect to the human body is excluded.

For variable magnetic fields, the maximum permissible values of the magnetic field strength and magnetic induction are established as a function of the duration of a person's presence in the magnetic field (Table No.39).

**Table No. 39.** Maximum permissible levels of the variable magnetic field (SanPiN 2.2.24.1191-03, extraction).

Presence time, hours	Maximum permissible levels of the magnetic field	
	H/B (A/m/mcTl)	
≤1	160/2000	6400/8000
2	800/1000	3200/4000
4	400/500	1600/2000
8	80/100	800/1000

Magnetic induction  $B$  is related to strength  $H$  by the following formula:

$$B = \mu_0 H,$$

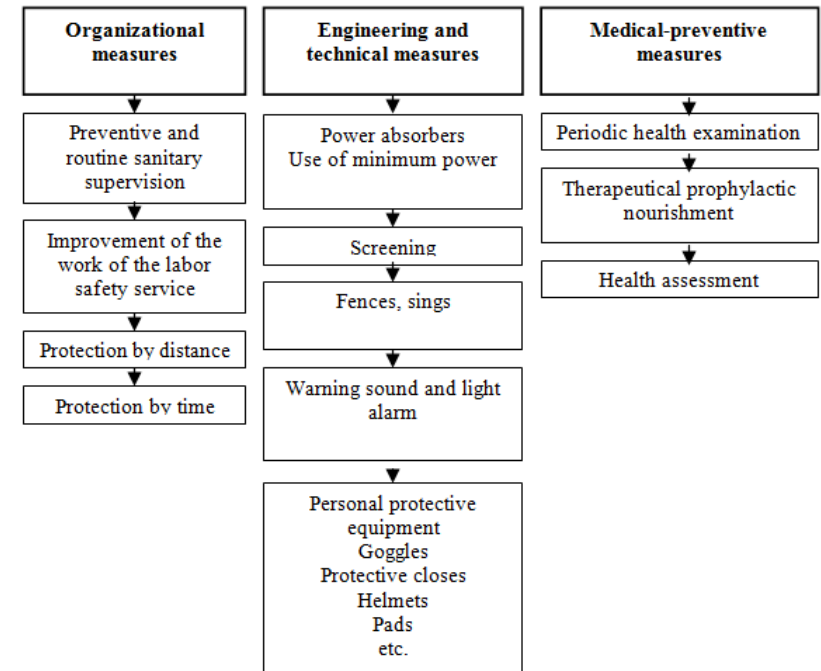
where  $\mu_0 = 4 \cdot 10^{-7}$  H/m is a magnetic constant. Therefore,  $1 \text{ A/m} \sim 1.25 \text{ mcTl}$  (H - henry, mcTl is - microtesla, which is equal to  $10^{-6}$  Tesla). The total exposure means the exposure to the whole body, the local - to the human limbs.

Setting of hygienic standards for infrared, ultraviolet and laser radiation is reflected in SN "Sanitary norms of ultraviolet radiation in production premises" No. 1.02.025-94; HN "Hygienic norms of intensity of infrared radiation from heated surfaces of equipment and fences in engine and boiler rooms and other production premises of ships" No. 1.02.026-94; SanPiN "Sanitary norms and rules for the design and operation of lasers" No. 1.10.074-94. Dosimetric control of laser radiation depending on its spectrum, type, impact on personnel, as well as the procedure for control over the condition of the production environment and use of laser devices are addressed in GOST 12.1.031-81 "Methods for dosimetric control of laser radiation" and GOST 32.1.040-83 "Laser safety. General provisions."

Standardization of *infrared radiation* is carried out according to the intensity of the permissible total radiation fluxes, taking into account the wavelength, size of the irradiated area and protective properties of the overalls; standardization of *ultraviolet radiation* in production facilities is carried out taking into account the permissible radiation flux density as a function of the wavelength, provided that the eyes and skin are protected; standardization of *laser radiation* is performed taking into account the energy exposure parameter. The regulation of the maximum permissible levels of exposure to laser radiation is determined by the dependence on the wavelength, duration of a single pulse, repetition rate of the radiation pulses and duration of the exposure. Different levels of exposure of laser radiation to the eyes (cornea and retina) and skin have been established.

**Preventive measures.** Ensuring safe working conditions and preserving the health of working communities employed at workplaces with devices emitting electromagnetic energy is associated with the need to comply with the maximum permissible

levels of irradiation and the use of a set of means and methods of protection. Figure No. 24 shows organizational, engineering and technical, and preventive measures to reduce the harmful effects of EMF.



**Figure No. 24.** Structure of preventive measures of protection of workers against the adverse effects of EMF.

The set of hygienic measures provides not only for control over the compliance with hygienic standards at the workplace, industrial site and other areas, but also over the observance of the work and rest regime, the use of rational specialized nutrition by working communities. An important role in the observance of hygiene standards is given to preventive and current sanitary

supervision, both in the examination of projects on construction of new and reconstruction of existing production facilities, and in the evaluation of the efficiency of operation of the most diverse devices that generate EMF.

Engineering and technical measures related to the creation of a set of protective measures aimed at reducing the levels of electromagnetic radiation at workplaces of personnel to values not exceeding the current standards include the following: designing and creating equipment with minimum levels of emissions; electro-sealing of separate elements of circuits and units in order to reduce the negative influence of electromagnetic radiation; protection by distance and time; screening of workplaces; use of personal protective equipment (PPE).

Naturally, in each specific case the method of protection is determined taking into account the operating frequency range of electromagnetic fields, nature of the work performed and effectiveness of protection. EMF sources are screened via reflective and absorbing screens made of metal sheets, grid, fabric with a microwire, etc. In the material of a metal screen, eddy currents emerge creating an electromagnetic field opposite to the screening one, as a result of which the electromagnetic field from the radiation source is localized or decreases. The screening device must be grounded. The design solution of the screen can be different in shape and size of a special used material.

The walls, floor and ceiling of the screened premises, in which these or other types of works are carried out, are covered with special radio absorbing materials. Personal protective equipment is also widely used - overalls, robes, goggles, helmets, shields, etc.

Protection against electrostatic fields is primarily based on a decrease of the intensity of generation of electrostatic charges, their removal from an electrified material and neutralization. The removal of already generated static electricity is most often performed by grounding the electrically conductive parts of the production equipment. An important means of protection against electrostatic fields is the increase in air humidity up to 65-75%, but only in cases where it is possible in terms of conditions of a technological process.

Equipment for protection against laser, infrared and ultraviolet radiation are quite multifaceted and are divided into collective and individual. The relevant standards of Occupational Safety Standards System of the Republic of Kazakhstan set forth the necessary requirements for the collective protection equipment. Personal protective equipment against laser, infrared and ultraviolet radiation includes safety glasses, attachments, special clothing, etc. Depending on a class, laser products are supplied with special screens made of fire-resistant non-melting material, signaling devices and remote control. For commissioning purposes laser products must have the necessary documentation - a technical passport for a laser product and a sanitary passport, operating manual and occupational safety rules.

The quality and timeliness of preliminary and periodic medical examinations of the working population play an important role in preserving the health and labor longevity of workers. The completeness of the efficiency of medical examinations, treatment and rehabilitation of industrial workers is one of the most important medical and preventive measures.

### **6.2.8. Ionizing radiations**

A human, under normal conditions of living and production activities, can be exposed to radiation from natural and man-made sources of radiation. The natural sources of ionizing radiation in relation to a human are divided into external and internal. The earth surface contains various natural radioactive elements (uranium, thorium, radium, actinium, potassium, rubidium, etc.), which serve as a source of many types of radiation. In nature there are also radionuclides (carbon, tritium, etc.), which owe their origin to the effect of cosmic rays on the nuclei of the atoms of stable elements contained in the air.

Natural radionuclides entering a human body with atmospheric air, food and water determine the internal natural ionizing radiation of a human. The most significant source of

radiation is radon, which is related to inert gases and represents a temporary product of uranium decay. Radon can penetrate and accumulate in a building's premises from the ground or be emitted by construction materials of mineral origin (brick, granite, ceramic granite, etc.) that contain a small amount of uranium.

High levels of radioactive elements are determined in some building materials made of slag, phosphogypsum (a by-product of phosphoric acid production), red mud (product of aluminum production waste), etc. Wide household use of consumer goods (radio-luminescent products, some electronic and electrical devices, antistatic devices, ceramic and glass products, as well as products made of alloys containing radioactive elements) may be accompanied by irradiation of the body.

Nuclear tests, disposal of nuclear waste, nuclear power industry facilities (nuclear power plants, nuclear reactors) lead to man-made radiation pollution of the environment. As a result of a combination of man-made and natural sources of ionizing radiation, the overall background of radiation exposure increased.

From the perspective of occupational medicine, professions potentially dangerous in terms of development of chronic radiation sickness are of special interest, which include medical workers (radiologists, X-ray technicians, X-ray lab technicians), technical personnel employed at nuclear reactors and nuclear power plants, submarines and icebreaking nuclear powered vessels. The work of researchers, as well as those involved in X-ray structure analysis, is also associated with the effects of ionizing radiation.

**Characterization of ionizing radiation.** *Ionizing radiation* is a radiation, which, passing through a medium, causes ionization or excitation of medium molecules. Ionizing radiation, as well as electromagnetic radiation, is not perceived by human sense organs. Therefore, it is especially dangerous, since a person does not know that he/she is exposed to it. Ionizing exposure is also called radiation.

*Radiation* is a flux of particles (alpha particles, beta particles, neutrons) or electromagnetic energy of very high frequencies (gamma or X-rays) that have different penetrating and ionizing capacities.

Alpha-particles have the lowest penetrating capacity, but they have the highest ionizing capacity. Beta particles have a higher penetrating capacity, but their ionizing capacity is a thousand times lower than that of alpha particles. Gamma and X-rays have a high penetrating capacity and are more dangerous at external exposure, and alpha and beta radiations are more dangerous at direct exposure to body tissues when they enter with inhaled air, food and water.

*Radioactive pollution* is a form of physical (energy) pollution associated with the excess of the natural level of radioactive substances in the environment as a result of human activities.

The *activity* of the radiation source is characterized by the number of nuclear transformations per unit time and is expressed in becquerels (Bq): 1 Bq = 1 decay per second (off-system unit Curie - Ci = 3.7 · 10<sup>10</sup> Bq).

When characterizing the absorption of radiation by biological objects, the following concepts are used:

1. *Equivalent dose* H - the main dosimetric value in the field of radiation safety, introduced to assess the possible damage to human health from the chronic effects of industrial ionizing radiation.

The equivalent dose is equal to the product of the absorbed dose by the average quality factor – *k* taking into account the biological effectiveness of different types of ionizing radiation. Measured in Sieverts, Sv, off-system unit - rem, 1 Sv = 100 rem.

2. *Equivalent dose rate* is the increment of the equivalent dose per unit time. The unit of equivalent dose rate is Sievert in seconds, Sv/s, 1 Sv/s = 100 rem/s.

3. *Effective equivalent dose* (EED) H<sub>e</sub> is a sum of products of the equivalent dose received by each organ H<sub>T</sub> per corresponding weighing factor W<sub>T</sub> taking into account various sensitivity of organs to radiation. EED ensures comparability and reduction of uneven exposure of the body to the same assessment of its consequences, as well as at uniform irradiation:

$$H_e = \sum_{T=1}^T H_T W_T$$



This value is measured in Sieverts, Sv. For example, the dose of lung irradiation of 1 mSv corresponds to EED = 0.12 mSv, i.e. shows that at a uniform irradiation of the whole body by a dose of 0.12 mSv, the probability of exposure to radiation is the same as when only lungs are exposed to a dose of 1 mSv.

Table No.40 shows the main parameters of radiation.

**Table No. 40.** Main parameters of radiation.

Parameters	International system unit (Si)	Unit	Relation between units
Activity	becquerel (Bq)	Kurie (Ku)	1 Ku = 3,7 · 10 <sup>10</sup> Bq
Half-life period	second	minute	-
		day	-
		year	-
Absorbed dose	gray (Gy)	rad	1 Gy = 100 rad
Equivalent dose	sievert (Sv)	rem	1 Sv = 100 rem

**The effect of ionizing radiation on the body.** The effect of ionizing radiation on the body is accompanied by the development of acute or chronic radiation sickness. The clinical symptom complex of radiation sickness depends on the type of radiation, dose, localization of the source of radioactive substances, distribution of the dose in time and in the human body.

The primary stage of the biological effect of ionizing radiation is the ionization of atoms and molecules of living matter, as a result of which ions and radicals are formed that have significant oxidation-reduction activity. In biological systems, these are basically radicals and ions that arise from water molecules: H<sup>+</sup>, OH<sup>-</sup>, and HO<sub>2</sub>. This process can be thought of as a chain of chemical reactions, during which the important for human body molecules (proteins, nucleic acids, lipoproteins, etc.) are damaged and biologically harmful reaction products generate. The damage to the structural integrity of cellular and intracellular membrane formations

due to the enhancement of lipid peroxidation processes is of significant importance.

As a result of these reactions metabolic and metabolic processes in the body deteriorate, leading to damage to individual organs and body systems. Developing tissue intoxication can express itself not only by the inhibition of the immune system, but also by clinical symptoms of disorder of the central and peripheral nervous system and functions of internal organs.

The radiosensitivity of cells and tissues occupies a central place in the mechanisms of the damaging effect of ionizing radiation on the body. At the same time one of the leading places in the pathogenesis of radiation sickness is assigned to the lesion of blood-forming organs. Inhibition of mitotic activity of poorly differentiated young blood cells is often accompanied by the development of panmyelophthisis and development of hemorrhagic syndrome.

The target organs for ionizing radiation are the epithelium of the small intestine, epithelium of the male and female gonads, and the skin. The nonspecific irritant effect of penetrating radiation leads to a functional disorder of the central nervous system and imbalance in neuroendocrine regulation.

Accumulation of products of peroxidation of lipids and radiotoxins is accompanied by an increase in the biological effect of ionizing radiation and development of body intoxication. Considering their damaging effect on the cell's genomic apparatus, normal cells degenerate into malignant cells.

The described biological effects of ionizing radiation can be significantly modified by irradiation conditions and other factors (dose, time, place of irradiation, overall condition of the body, age and sex, nature of the body's supply with micro- and macronutrients).

**Setting of hygienic standards for ionizing radiation.** At the present time, sufficiently effective measures and rules for protecting people working with sources of ionizing radiation have been developed. Prevention of radiation damage is realized by the implementation of a set of sanitary-hygienic, sanitary-technical and special medical measures. Sanitary and hygienic requirements for ensuring radiation safety (SanPiN No. 5.01.030.03 of 31.01.03,

Ministry of Health of the Republic of Kazakhstan) and the Norms of Radiation Safety (NRB-99) establish appropriate standards to ensure safe working conditions. The norms set the limits of the equivalent dose for certain categories of workers and the population.

In addition to radiation dose limits, NRB-99 sets permissible levels of dose rate for external irradiation, limits of annual radionuclide intake, permissible levels of contamination of working surfaces, etc., which are derived from the main dose limits. The numerical values of the permissible level of contamination of the working surfaces are given in Table No.41.

**Table No. 41.** Permissible levels of general radioactive contamination of working surfaces, particles ( $\text{cm}^2 \cdot \text{min}$ ) (extraction from NRB-99).

Contamination object	$\alpha$ -active nuclides		$\beta$ -active nuclides
	separate	other	
Intact skin, towels, special clothing, inner surface of facial parts of personal protective equipment	2	2	200
Basic overalls, inner surface of additional personal protective equipment, outer surface of safety footwear	5	20	2000
Outer surface of additional personal protective equipment removed in clean rooms	50	200	10 000
Surfaces of the premises of permanent stay of personnel and of the equipment located therein	5	20	2000
Surfaces of the premises of periodic stay of personnel and of the equipment located therein	50	200	10 000

**Preventive measures.** Protection measures when working with open radioactive substances require a special design and layout

of premises, which, in turn, depend on the class of radiation hazard. Specific requirements are set for equipment, ventilation systems, water supply, sewerage and personal hygiene measures. The above activities help to prevent the possibility of air pollution in industrial premises, equipment and overalls with radioactive aerosols, gases and vapors.

An important component of the radiation safety system is the dosimetric and sanitary control over the degree of contamination with radioactive substances, over the state of the air environment and exercise of individual dosimetric control.

When working with radioactive substances and sources of ionizing radiation, it is important to have a correct labor organization that ensures radiation safety of personnel, within with exposure levels from sources of external and internal irradiation should not exceed the regulated dose limits for relevant categories of persons.

Within the framework of preventive and current sanitary supervision, when working with closed sources of ionizing radiation, a number of principles for ensuring radiation safety are justified: 1) reduction of the intensity of ionizing radiation sources to minimum values ("protection by quantity"); 2) reduction of the time of work with the source of ionizing radiation ("protection by time"); 3) increasing the distance from the ionizing radiation source to the working workers ("protection by distance"); 4) screening of sources of ionizing radiation by materials absorbing ionizing radiation ("protection by screens").

According to the existing legislation of the Republic of Kazakhstan in the field of sanitary and epidemiological welfare and other normative legal acts of the Ministry of Health of the Republic of Kazakhstan, a major role in preventing the adverse effects of ionizing radiation on workers and population as a whole belongs to regularly conducted occupational health examinations.

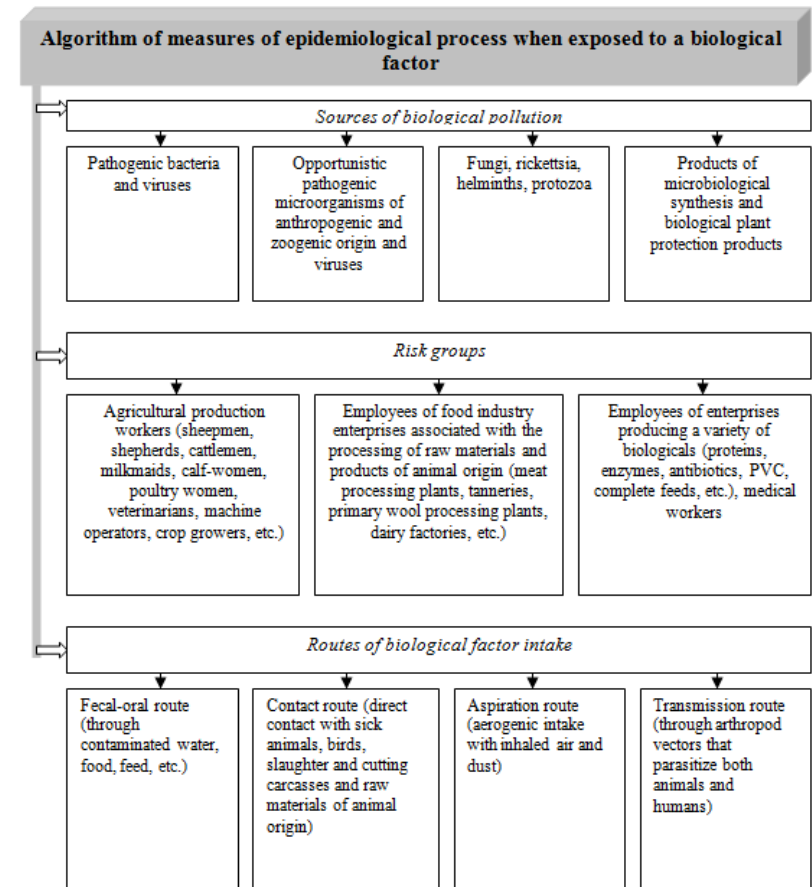
### 6.2.9. Biological factor

In recent years, the importance of the biological factor of the working space and the environment has undoubtedly increased in connection with the intensive growth of cities and urban-type settlements. Biological contamination includes pathogenic bacteria and viruses, opportunistic pathogenic microorganisms of anthropogenic and zoogenic origin, microorganisms-producers, products of biotechnological industry (antibiotics, antibiotic-containing preparations, vitamins, enzymes, fodder yeast, etc.) and biological plant protection products.

The *biological factor*, as is known, is the totality of biological objects, the impact of which on a person or the environment is associated with their ability to reproduce under natural or artificial conditions or to produce biologically active substances. The main components of the biological factor, which have an adverse effect on humans, are the most diverse microorganisms and metabolic byproducts as well as some organic substances of natural origin.

The ever-increasing role of the microbiological industry associated with the production of amino acids, vaccines, immunogenic preparations, food supplements, protein-vitamin concentrates, is accompanied by an increase of the level of anthropogenic biological contamination of environmental objects. The use of yeast, mold fungi, actinomycetes and bacteria in industrial production has led to the emergence of a qualitatively new type of biological pollution - microorganisms, producers and their metabolic byproducts, which also pollute the air of industrial premises and the environment.

In view of the foregoing, it is extremely important not only to identify the sources and ways of spreading biological pollution, but also to clarify the role of each of the individual biological factors in the development of human pathology in order to develop measures to limit their harmful effects on the health of workers and the population living in close proximity to agricultural and biological industry enterprises (Figure No.25).



Picture No. 25

***Principles of hygienic standardization of biological factors.***

A scientifically grounded system for monitoring the quality of environmental objects with respect to bacterial and viral contamination based on hygiene requirements that are formulated in sanitary legislation documents and aimed at ensuring epidemic safety, forms the basis for non-specific prevention of infectious

diseases. In this regard, the issues of development and scientific substantiation of hygienic regulation of microbial pollution of the environment have been and remain relevant, both at the present time and in the future.

Water of various water use types, soil and air in enclosed premises can be factors of the spread and transmission of a number of infectious diseases of bacterial and viral origin (mainly intestinal and respiratory). Data on the epidemiology of intestinal infections (cholera, typhoid fever, paratyphoid, dysentery, etc.) show a significant role of the water factor in their spread. The greatest epidemiological danger is represented by violations in the system of centralized water supply, which account for up to 80% of outbreaks of infections of water origin. The water factor, along with the food chain, also contributes to the spread of salmonella toxicoinfection.

Soil can also have a harmful effect on human health when it is polluted by pathogenic enterobacteria and intestinal viruses with sewage, when there is a direct contact of a human with soil during field works, and through contaminated vegetables, shoes, etc. Work in plant houses and greenhouses, regardless of the season, can lead to various infectious diseases in case of non-observance of sanitary and hygienic working conditions.

Household, hospital and some types of industrial wastewater are the main sources of microbial pollution of water bodies. The most epidemic danger is insufficiently treated and disinfected waste water of infectious hospitals, as well as of children's hospitals, in which there are patients with chronic intestinal diseases. In this case, it is necessary to take into account the specific and strain characteristics of pathogenic microorganisms entering the water. The increased vital capacity of the synthomycin-resistant strains of Sonne and Flexner bacteria was found in comparison with the synthomycin-sensitive strains.

In order to assess the sanitary significance of various and indicator microorganisms and determine their regulatory levels, quantitative dependencies and correlative relationships between their content in water and water pollution by intestinal infections are established. Thus, a high degree of direct connection between the

content in water of salmonella and Escherichia coli group bacteria, salmonella and lactose-positive Escherichia coli, salmonella and E. coli, salmonella and phages of Escherichia coli, as well as intestinal viruses and phages was obtained.

The accepted normative level of microbial contamination by various indicator microorganisms is the level at which pathogenic bacteria and intestinal viruses are not released from the water of reservoirs in conditions of their industrial and domestic pollution and at decontamination of the draining wastewater: lactose-positive Escherichia coli, E.coli no more than 1000 in 1 liter, enterococci no more than 100 in 1 liter, phages of E.coli no more than 1000 cells/liter.

The national standards for drinking water, in order to increase its epidemic safety, includes requirements for water purification and disinfection to the extent that ensures the maximum removal of intestinal viruses from it. Thus, according to GOST 2874-82 "Drinking water", the concentration of free residual chlorine in water when decontaminated shall not be not less than 0.3 mg/l with the contact for at least 30 minutes or bound chlorine - no less than 0.8 mg/l with the contact for 1 hour. The content of residual ozone after the mixing chamber should be 0.1-0.3 mg/l with the contact for at least 12 minutes. A significant total effect of water purification from saprophytic microorganisms, E. coli group bacteria and phages is achieved at pilot plants by coagulation, sedimentation and filtration.

In the spread of respiratory infections of bacterial and viral nature, atmospheric air under ordinary conditions is not of substantial significance. The main factor in the spread of aerogenic infections is the air of enclosed premises, primarily hospital ones. As a rule, outbreaks of hospital-acquired infections in maternity hospitals, children's and surgical departments are most often caused by epidemic strains of St.pyogenes. The possibility of contamination of air in living and medical premises by such pathogens of bacterial and viral infections as hemolytic streptococci, meningococci, viruses of influenza, smallpox, etc. has also been revealed. The dissemination of hospital premises' aerial environment with microorganisms

depends to a large extent on the air exchange rate, observance of the disinfecting regime, cleaning type and so on.

Hygienic standards for microbial contamination of indoor air are established only for surgery blocks of surgical departments and maternity hospitals. The total bacterial contamination of the air of the surgery blocks prior to a surgery shall not exceed 500 cells/m<sup>3</sup> and 1000 cells/m<sup>3</sup> - by the end of the surgery. The presence of *Staphylococcus aureus* is not allowed.

Existing MPC for microorganisms-producers, as a rule, are maximum, and most of them have pronounced sensitizing and allergenic properties. Being in the air of the working zone in the form of aerosols, the values of the hygienic standards of microorganisms-producers are expressed in microbial cells per one cubic meter (cells/m<sup>3</sup>). MPC of microorganisms-producers in the air of the working area is limited to 50,000 cells/m<sup>3</sup>.

The majority of microorganisms-producers and their metabolic byproducts can have an unfavorable effect both on the people engaged in production, and on the population living in the zone of influence of these industries. Nevertheless, up to now, for the majority of products of microbiological synthesis the temporary (SRLI) and permanent (MPC, MPL) hygiene standards have not been developed, there is no scientific justification for sanitary protection zones, there are no hygienic regulations for preparations of the microbiological industry in atmospheric air by microorganisms - producers, and for such an important object of the environment as the soil, hygienic standards are absent at all.

It should be noted that the biological factors have not only a toxic and allergic effect on the body, but also a specific effect. On the basis thereof the biological factor, as one of the harmful and dangerous factors of the production environment, is included in the corresponding hygienic classification of labor. Therefore, an important activity of the health authorities is the organization of clear and operative control over the pollution of the industrial spaces and environment with microorganisms and biologically active substances. Methods for controlling the biological factor in the aerial

environment are regulated by many normative documents and methodological guidelines.

In accordance with the methodological guidelines on setting of environmental standards for microbial preparations in the work environment, as well as when studying the working conditions, health status of workers in the production of microbiological preparations, the following points should be taken into account: 1) to provide a more careful approach the evaluation of the technological process and duration of exposure to dust; 2) to assess the aggregate state of the biological preparation, its activity and duration of storage; 3) to determine the number of microbial bodies in one gram of the biological preparation, and also give a toxicological and hygienic characterization of the filler used in methodologically correct manner; 4) to deduce the full-fledged sanitary-and-hygienic characteristic of the dust content, including microbial bodies at workplaces taking into account peculiarities of technologies and a season.

In the following normative documents, the complex sanitary and hygienic requirements for the improvement of working conditions at enterprises related to the impact of the biological factor are defined: SanPiN "Sanitary and epidemiological requirements for the maintenance and operation of facilities for the production of vegetable oils" No. 277 dated May 15, 2008; SanPiN "Sanitary and epidemiological requirements for the maintenance and operation of grain storage facilities (elevators and grain reception centers)" No. 293 dated 10.07.2006; SanPiN "Sanitary and epidemiological requirements for working conditions with microorganisms of I-IV risk groups" No. 325 dated 05.07.2005; SanPiN "Sanitary and epidemiological requirements for the maintenance of facilities for the production of milk and dairy products, their storage and transportation" No. 201 dated April 28, 2005; SanPiN "Sanitary and epidemiological requirements for the maintenance and operation of livestock and fur farming facilities" No. 143 dated 24.03.2005; SanPiN "Sanitary and epidemiological requirements for the maintenance and operation of facilities for the production of meat and meat products, their storage and transportation" No. 60 dated

17.02.2005; SanPiN "Sanitary and epidemiological and veterinary-sanitary requirements for the maintenance and operation of facilities intended for the collection of milk" approved by Orders No. 105/214 of the acting Minister of Health of RK dated 09.03.2005 and Ministry of Agriculture of RK dated 18.03.2005.

**Preventive measures.** Prevention of adverse effects of biological factors consists of combating animal diseases, adherence to sanitary and hygienic standards and combating pollution of agricultural industry enterprises, sanitary and hygienic monitoring of working conditions of working communities.

In this connection, the improvement of technological processes is of particular importance. Improving the efficiency of industrial emissions cleaning systems, strict adherence to the modes of sealing of air pollution sources in the work area, ensuring efficient operation of industrial ventilation, and introducing non-waste technologies play a vital role in preventing pollution of production facilities, atmospheric, water and soil by the biological factor.

Under current conditions the role of sanitary and microbiological control over the quality of certain environmental objects and of the development of appropriate methods of analysis is increasing. Each biological preparation newly introduced into production conditions must have toxicological and microbiological characteristics, medical and hygienic recommendations for its application. Regulation and standardization of the biological factor plays an important role in the system of preventive measures.

Conducting preliminary and periodic medical examinations is of particular importance. Periodic medical examinations shall be conducted with the obligatory participation of an allergist and dermato-venereologist. It is also important, when examining the allergological status, not only to set up skin patch tests and specific allergic tests, but also to use samples that characterize the sensibilization of the body.

Great importance should be attached to the provision of workers with personal protective equipment and overalls, observance of rules of personal hygiene and the organization of a rational schedule of work and rest. Both almost healthy persons, but having

separate signs of a disease (risk group), and patients shall pass the regular medical examination. For the preventive purposes, the use of immunomodulators, which promote the normalization of clinical and immunological parameters and increase the nonspecific resistance of the organism, is recommended.

### 6.3. Workflow factors

#### 6.3.1. Special aspects of labor activity psychophysiology

The role of the human factor is important not only in creating a final product, but in ensuring safe working conditions. The psychophysiological characteristics of participants of the work process are of special importance. The performance of physical and mental work in the process of industrial activity sets certain requirements to the body. At the same time, the factors of the labor process that determine the working conditions affect not only a person's performance capability, but also the state of his/her health.

The main indicator of a person's labor activity is considered to be his/her performance capability, that is, the ability to produce formed and purposeful actions. From the physiological point of view, it is the ability of the human body to withstand the specified physical and emotional loads during the labor process. The workload, depending on the quantitative and qualitative characteristics of its components, leads to varying degrees of strain of the physiological functions of the organism of the worker. If the intensity of labor activity proves to be higher than the reserve functional capabilities of the human body, a state of *fatigue* may develop that is accompanied by a decrease of the performance capability.

The degree of fatigue depends both on the work load, and on the duration of its performance. In the absence of overloads causing fatigue, the performance capability of the body when stopping the work or changing the type of activity is fully restored. However, if after the work the rest is insufficient to restore the performance capability to the beginning of the next labor period, then

there is an accumulation of fatigue, which eventually leads to *overfatigue*.

The overfatigue is accompanied by a number of sign symptoms: a feeling of fatigue even before commencing the work; increased irritability; decreased interest in the work and associates; decreased appetite and weight loss; sleep disturbance; difficult falling asleep and awakening. The overfatigue leading to incoordination of the functional state of the body contributes to an increase in the overall incidence and development of occupational diseases.

Physical labor is characterized not only by the load on the musculoskeletal system and its functional systems (cardiovascular, nervous, muscular, respiratory, etc.), but also by the stimulation of metabolic processes in the body, development of the muscular system and its training level. The physical capabilities of a person are determined by the strength of the muscles, muscular endurance and anthropometric data.

Depending on the amount of muscle mass involved in the work, general, regional and local physical activities are distinguished. Physical work is called *general*, when more than 2/3 of the muscle mass are involved in the work, *regional*, when 1/3 to 2/3 of the total muscle mass is involved in the work and *local*, when no more than 1/3 of the whole muscle mass of a person is involved in the work. There are also *dynamic* and *static* physical loads.

Muscle mass depends on the strength of muscles and the level of flexion of the joint, which, in their turn, are determined by the mobility of nervous excitations and the rate of muscle contractions. Moderate workload, under normal production activity conditions, can be accompanied by the activation of physiological functions and increase of metabolic processes in the human body and, under certain conditions, lead to an increase of the functional potential of the muscles.

Table No.42 provides data on the strength of individual muscle groups of a human.

**Table No. 42.** Strength of certain muscle groups of a human body.

<b>Strength, N (Newton)</b>	<b>Male</b>	<b>Female</b>
Hand strength: right hand	380	218
Left hand	355	200
Bicep strength: right hand	274	133
Left hand	263	128
Wrist flexion: right hand	274	213
Left hand	261	203
Back strength (muscles straightening a bent corpus)	1210	696

The strength that a person develops depends on a number of factors and is very different for different people. The strength of the muscles depends not only on gender differences, but also changes with age. The greatest muscular strength is observed at the age of 20-29 years, then starting from the age of 50 years it is gradually decreasing in the strongest manner; the strength of persons of the age group of 60-69 years is 20-45% lower than that of persons aged 20-29 years.

Tense muscular activity causes an increase in basal metabolism, the intensity and duration of which are proportional to the heaviness of the work performed. At the same time, mechanical energy developed by muscles while performing all kinds of physical work, is produced as a result of oxidation of carbohydrates, fats and proteins. In its turn, the need for energy necessary to ensure normal living can vary significantly and depends on a number of factors: magnitude of the basal metabolism, expenditure of energy on active muscle activity and expenditure of energy on the specific dynamic effect of food.

Organism energy expenditure allows us to form an opinion not only about the degree of intensity of muscular work, but also to have an idea about the energy expenditure of people of some professions (Table No.43). It should be noted that in specific conditions of the production environment, energy consumption depends on the size of the body weight and height, pace of work and

its duration, nature of a person's activity during leisure time and degree of physical activity during rest.

**Table No. 43.** Daily energy expenditure of people at different types of activity.

Profession	Number of calories per day
<i>Metalworking industry workers</i>	
turning, tool and insulating-winding shops	3200-3400
forge shop	3700
rolling shop	3800-3900
casting shop	4000-4200
<i>Chemists</i>	
instrumentation worker	3250-3400
upper furnace operator	3800
lower furnace operator	4100
ore porter	4500
<i>Builders</i>	
carpenter	4500-4600
hod carrier	5360
bricklayer	4000
steel fixer and plasterer	3872-4093
motorist	3260
<i>Agricultural workers</i>	
tractor operator	3000
ploughman	5000
vegetable garden worker	4100-4800
grass-mowing machine operator	3500
shearer	7000
bandster (manually)	5600
<i>Railway transport workers</i>	

conductor, driver, driver's assistant	3000
connector, millwright, greaser	3500
porter, sorter, track maintenance worker	4000-4500
<i>Military servicemen</i>	
rifle unit (in barracks)	3600
rifle unit (in camps)	4000
gunman	3800-4100
cavalryman	4000-4300
<i>Students</i>	
medical university student	2900-3000
» technical college	3100-3200
schoolchildren 8-10 years old	1900
» 12-14 years old	2400

**Labor heaviness** is a characteristic of the labor process reflecting the primary load on the musculoskeletal system and functional systems of the body (cardiovascular, respiratory, etc.) that ensure its activity. Labor heaviness is characterized by the physical dynamic load, mass of the lifted and moved cargo, total number of stereotyped work movements, magnitude of the static load, nature of the working posture, depth and frequency of the body bendover, movements in space.

#### Indicators of labor process heaviness

*Physical dynamic load* is the weight of a load that is moved manually in each operation and the route of its movement. The physical dynamic load can be regional (with the predominant participation of the muscles of the arms and shoulder girdle) and general (with the participation of the muscles of the hands, body, legs).

The *weight of a manually lifted and moved load* can be constant throughout the entire shift and when alternating with another work. In both cases, the weight of loads moved during each shift hour is determined individually from the work surface and individually from the floor.

*Stereotyped working movements* are the number of movements per shift separately for the muscles of hands and fingers



(local load) and separately for the muscles of arms and shoulder girdle (regional load). To determine this indicator, a list of repetitive work movements is compiled.

*Working posture.* Designing a workplace should be guided by comfortable working postures, which should be as close to natural as possible. The natural posture when sitting is taken spontaneously. The fixed working posture is not physiologically justified. Working in a standing position leads to faster fatigue than working in a sitting position. Given that the fixation of any of the considered postures causes blood circulation failure in the lower extremities and pelvic region, it is advisable to provide the possibility of working both standing and sitting.

*Body bending.* The depth and heaviness of performing these operations are provided by the abdominal muscles and lumbar muscles, which experience considerable stresses when frequent inclinations of the body are necessary, even if this is not related to the movement of weights.

*Moving in space.* Moving in space is understood as transitions during the working shift caused by the technological process. If an employee is exposed to light physical exertion, then he/she easily endures relatively small movements. However, the combination of physical exertion with prolonged walking can make the work significantly more difficult.

Neuropsychic and physical overworks very often accompany the labor activity of people of various professions. The constant process of complicating the production activities of people of many specialties, due to the widespread introduction of new technologies and innovative solutions, sets increased requirements to their psycho-emotional capabilities.

Under the current condition, when solving production-important tasks, there is a close interlacing of intellectual and emotional activity. Considering the complex and contradictory current socio-economic situation in the country, which in itself often causes a neuropsychic strain of a person, the significance of this harmful factor of the labor process in the development of unfavorable deviations in the health of the working population greatly increases.

Neuropsychic loads relate primarily to the mental activity of an employee and they have such specific indicators of the intensity of the work process as the content of work, perception of signals (information) and their evaluation, distribution of functions by the degree of complexity of tasks and nature of the work performed.

Information capabilities of a person are characterized by the speed and volume of perception and processing of information. The ability to perceive information almost never exceeds 10 signals per second. The information transmission capabilities (even with advanced skills) are limited to approximately 25 bits per second. The average speed of simple operations without preliminary preparation is about 2 bits per second. The maximum speed of information reception with various sense organs is given in Table No.44.

**Table No. 44.** Maximum information reception rate with various sense organs.

Signal modality	Characteristic	rate, bit/s
Visual	Line length	3,25
	Area	2,7
	Line direction	3,3
	Line flexion	2,2
	Color	3,1
	Brightness	3,3
Acoustical	Loudness	2,3
	Pitch of sound	2,5
Gustatory	Saltiness	1,3
Tactile	Intensity	2,0
	Length	2,3
	Location on the body	2,8
Osmetic	Intensity	1,58

In the course of evolution, humans have acquired the ability to sense and recognize the adverse effects of factors of the production environment and work process with certain analyzers (sense organs). Thanks to analyzers, a human can perceive and recognize a color, brightness, smell, taste, shape and movement of objects, effect of

high and low temperature, pitch and volume of sound, effect of vibration and action of gravity, etc. At the same time, the sensitivity of analyzers (ability of a human to recognize the action of stimulants) depends on the state of the human body. Excessive neuropsychiatric loads lead to a change in psychomotor abilities: speed of motor reaction, coordination, stability and accuracy of movement. The lag phase of sensorimotor reactions is the period between the beginning of action on the human organs and the instant of response. Table No. 45 presents the lag phases of various responses.

**Table No. 45.** Lag phases of various responses.

<b>Reflex response</b>	<b>Lag phase, ms</b>
Tendon reflexes:	
Wrist extensor	65-70
knee reflex	70-100
ankle reflex	120-190
biceps reflex	140-160
To painful electrodermal stimulation	100-120
To acoustical stimulation	140-160
To photic stimulation	160-220
To acoustical and photic stimulation with a choice	220-340
To thermal stimulation (painful)	360-440
To thermal contact stimulation	500-800
To cold contact stimulation	350-450
To thermal radiation stimulation	1000-1400
To cold radioactive stimulation	2-5 min
Vestibulo-motor responses	
to angular acceleration	250-280
to rectilinear acceleration	320-380
To osmotic stimulation	700-1000

The speed of response to a stimulant depends on the following factors: 1) modality of the stimulant; 2) intensity of the stimulant (response time decreases with increasing intensity of the stimulant to a certain limit, with a further increase in the intensity of the stimulant no change in the response time is observed); 3) training

level; 4) mindset of a person (readiness to perceive a signal reduces the response time); 5) motor response complex (right arm and leg usually move faster than the left ones); 6) age and sex; 7) complexity of the response (a response can be simple - a choice out of two possible solutions, and complex - a choice out of a few possible solutions).

Initial functional changes in the body of a person in the process of mental labor usually come with a change of the higher nervous activity functions. In recent years, in the area of emotions and mental activity of workers in numerous professions, there is a significant intensification accompanied by the fact that workers often do not have time to adequately respond to all production and semantically important information. In this regard, there is an accumulation of an increasing number of unresponded emotions and non-fulfilled tasks of an industrial nature, affecting human health.

In this aspect, a human's intellectual abilities play the most important adaptive-realization role. Intellectual abilities are determined by higher mental functions - attention, memory, imagination and thinking. At the same time, any mental activity is accompanied by a nervous-emotional tension. In turn, the emotional tension is caused such characteristics of labor activity as the significance of the work, its danger, responsibility. The mental work is characterized by hypokinesia is characteristic (decreased motion activity), which is the condition for the formation of cardiovascular disorders with humans.

**Labor intensity** a characteristic of the labor process reflecting the load mainly on the central nervous system, sense organs and affection of a worker. Factors characterizing the labor intensity include: intellectual, sensory and emotional loads, load monotony degree, working pattern.

### **Indicators of the labor process intensity**

*Intellectual load.* In the process of production activity, a person performs tasks of varying degrees of complexity. Mental work, in which there is no need to make decisions, is considered easy. If an employee makes decisions within the framework of the instruction, then such working conditions are permissible. The labor associated with solving complex problems with the use of several instructions is considered to be of high intensity. Labor intensity, when studying the intellectual load, includes processing, checking and monitoring the performance of an assignment, work on the distribution of the production assignment among other persons and control over their work. It is necessary to take into account the nature of the production assignments that provide for the performance of work under an individual plan, according to the established schedule, and also for the final result, but in the conditions of time deficit.

*Sensory loads.* This stage is assessed by studying the duration of focused observation, estimating the density of signals and messages, the number of production facilities that are being monitored, and the load on the visual and auditory analyzer.

*Emotional loads.* Inherent to a human sthenic (determination, joy, enthusiasm, excitement) and asthenic (fear, fear, fear, fright) emotions affect the sense of responsibility of an employee for the result of his/her own activity. In the process of performing labor duties, both assessment of the risk both for one's own life and of the degree of risk for the safety of others play an important role in determining qualitative working conditions. With the increasing complexity of the tasks being solved, taking into account the possibility of emergence of conflict situations in a team, the probability of emotional stress increases.

*Monotony of loads.* The monotony of execution of simple elements of the operation at a set or free pace, or the works with a sensory or mental load of low and medium intensity, in the absence of novelty elements are accompanied by the development of monotonia. This circumstance leads to the fact that monotonous work reduces not only labor productivity, but also increases the accident and injury rate in production. The degree of monotony is determined

by the number of elements and duration of the execution of these elements or operations.

*Work schedule.* Human performance capability is determined not only by the activity of the muscular apparatus and sensor organs, but also by the activity of the cardiovascular, digestive, endocrine and other systems not controlled by human consciousness and working under a circadian rhythm. Therefore, the actual length of a working day, duty-duty schedule, presence of regulated breaks and their duration, determining the work schedule, serve as significant indicators of neuropsychic loads.

Consequently, the knowledge of subtle neurophysiological and neuropsychological mechanisms of neuro-emotional overstrain and their quantitative and qualitative assessment are important for determining the nature and characteristics of labor activity and are a prerequisite for developing ways to eliminate them.

In modern production, the main factors of the labor process capable of affecting the functional state of workers are stereotyped repeated local muscle strains, prolonged maintenance of forced working postures, monotonous, nervous and psychoemotional stress. It should be added that in real production conditions a combined effect of neuropsychiatric loads with harmful factors of the production environment (noise, vibration, unfavorable microclimate, etc.) is revealed. Their effect on the human body can increase as a result of the lack of proper professional selection, irrational and omitting ergonomics requirements design of the tool and workplace, process controls, hypokinesia and unbalanced nutrition.

*Preventive measures.* When developing preventive measures, one must proceed from the need to preserve and restore all physiological functions and the psychoemotional sphere of a worker. It is necessary to take into account a lot of factors that negatively affect the overall condition and performance: heaviness and tension of the work performed, peculiarities of the workplace arrangement and many others. Knowledge of individual psycho-physiological responses of the body to the workload is also important in the development of preventive measures.

Along with the measures to reduce the proportion of heavy physical labor, serious attention should be paid to justifying measures to reduce fatigue when performing local muscular work. Widely using the technology of application of various means of small-scale mechanization, it is necessary to reduce the number of movements and static stresses and reduce the amount of applied muscular effort during the performance of labor operations; to introduce regulated breaks for production gymnastics and self-massage of hands.

The correct location and layout of the workplace, ensuring a comfortable posture and freedom of labor movements and using the equipment that meets the requirements of ergonomics and engineering psychology provide the most efficient work process, reduce fatigue and prevent the danger of occupational diseases. Special professional selection and training young workers to apply rational physiological methods of work make it possible to ensure primary prevention of diseases of the musculoskeletal system.

The most significant means of occupational improvement in the conditions of monotony, psychoemotional and visual overstrain are a complete automation of production processes, improvement of machinery and technology, introduction of rational regimes of work and rest. Preventive measures should also include psychological, educational, socio-economic and health-improving measures.

### **6.3.2. Ergonomics in occupational medicine**

Comprehensive study of the "human-machine-production environment" system allows not only to create healthy and safe working conditions, but also to ensure the harmonious development of a human's personality. In the process of labor, all the components of this system are closely interlinked, thereby ensuring the necessary safety and labor productivity, performance capability and health of humans. The ever-increasing automation and mechanization of production, introduction of modern innovative technologies, including nanotechnologies, impose strict requirements on people in terms of performing the management and operator function. In

modern conditions, the subject of rapidly developing science - ergonomics is the study of psychophysiological capabilities and anthropometric characteristics of a human in the "man-machine-production environment" system.

**Ergonomics** is a scientific discipline that studies labor processes in order to optimize tools and conditions of labor and improve the efficiency of work and preserve the health of workers.

Ergonomic researches and developments consist in the creation of a scientific and technical base in the "human-machine-production environment" system (in the study of the characteristics of a human, machine, industrial environment, nature of the interaction of these components in specific conditions of production, creation of jobs, machines and control panels providing the maximum convenience for people, i.e. the optimal condition for interaction with the machine and the control object).

The main ergonomic terms and definitions are given in GOST 26387-84. According to this standard, the human-machine system consists of a human operator (a group of operators) and a machine through which the labor activity is carried out. Human operator is a person who carries out the labor activity, the basis of which is an interaction with the object of labor, machine and external environment via the information model and management bodies. The machine in the "human-machine" system is the aggregate of technical means used by the human operator in the process of labor activity. The activity of the human operator is the process of achieving the objectives set in the system, consisting of a well-ordered set of the human's actions.

In order for the human-machine-production environment system to function effectively and not to damage human health, it is necessary to ensure the compatibility of the characteristics of a machine and a human. In turn, the compatibility of a human with a machine is determined by his/her anthropometric, biomechanical and sensorimotor abilities. *Anthropometric compatibility* implies consideration of the size of a human body and its compliance with the design features of production equipment and workplace arrangement. *Sensorimotor compatibility* implies consideration of the

speed of human motor operations and his/her sensory responses when working on equipment and machines with different speed regimes and signaling. *Biomechanical compatibility* implies consideration of the power (physical) capabilities of a human in determining the efforts attached to the control organs. *Psychophysiological compatibility* implies the consideration of human responses to color, shape, volume and other aesthetic parameters of the machine.

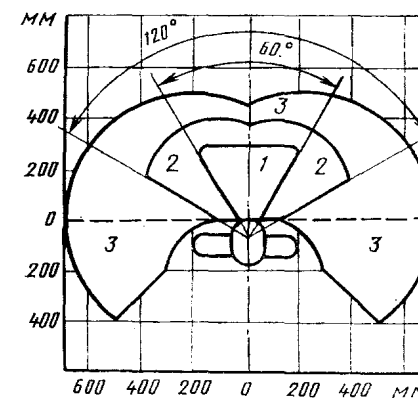
**Workplace arrangement.** The performance of a human and effectiveness of his/her work activity largely depend on how well the ergonomic requirements are taken into account in the design of equipment and workplace arrangement. Failure to comply with these requirements leads to unnecessary labor efforts and movements, which ultimately increase the tension of the workers' body functions.

Anthropometric (human body size, its individual parts - head, legs, hands, wrists, feet, shoulder width, etc.) and dynamic (possible turning angles of individual body parts, reach areas) human characteristics specify the design features and dimensions of a workplace and mutual arrangement of its elements. When designing production equipment and building dimensional ratios at the workplace, it is necessary to take into account the anatomical and physiological differences between men and women.

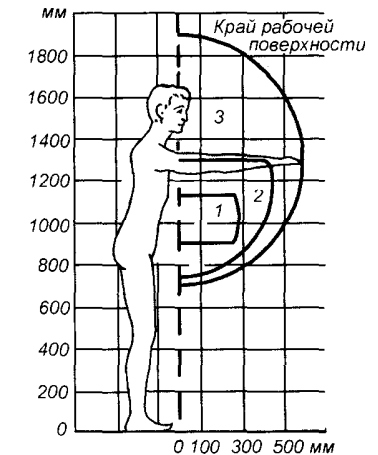
A workplace shall provide the possibility of performing labor operations within the reach area of the body field. Figures No.26, 27 show the areas where controls are placed in the horizontal and vertical planes. In this case, if more than two operations are performed in one hour, the workplace is organized so that these operations are performed within easy reach and optimum zone of the body field. Execution of working movements within the optimal zone significantly reduces muscle tension.

When working in a standing position, the height of a working surface must be selected taking into account the height of a worker and heaviness of labor. Therefore, it is desirable that this height can be adjusted. In the event that the height of a working surface is not regulated, it is accepted under a special nomogram (Figure No. 28) for a worker having the height of 1 m 80 cm. For workers of smaller height, it is necessary to provide height-adjustable footrests. When it

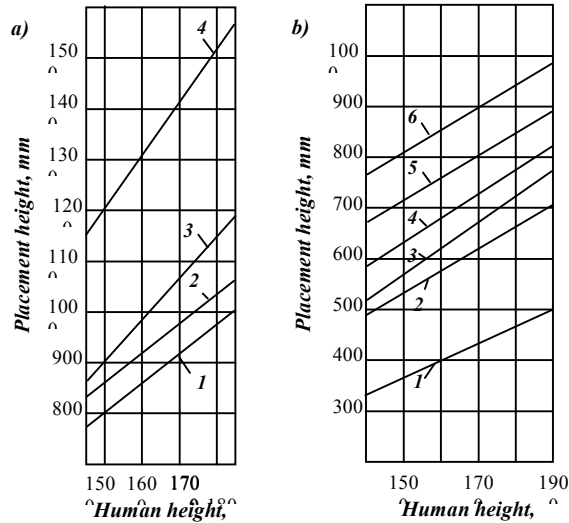
is not possible to adjust the height of a work surface and height of a footrest, it is allowed to design and manufacture equipment with a non-adjustable height of a work surface and height of a footrest. The numerical values of a working surface height are determined according to the table.



**Figure No.26.** Zones for performing manual operations and placement of controls: 1 - zone for placing the most important and very often used controls (optimum zone of the body field); 2 - zone for placing frequently used controls (easy reach zone of the body field); 3 - zone for placing rarely used controls (reach zone of the body field).



**Drawing No.27.** Zones for performing manual operations and placement of controls in the vertical plane: 1 - zone for placing very often used and most important controls (optimal zone of the body field); 2 - zone for placing frequently used controls (easy reach zone of the body field); 3 - zone for placing rarely used controls (reach zone of the body field).



**Figure No. 28.** Nomograms of dependencies of the placement height on a human's height in regard to: a - work surface for heavy work (1), work of medium heaviness (2), easy work (3) and information displays (4) while working in a standing position, b - working seat (1), legroom (2), work surface for assembly work (3), easy work (4), fine works (5), and very fine visual works (6) while working in a sitting position.

To ensure a convenient, possibly close approach to a table, lathe or machine, a footstep space of at least 150 mm in depth, 150 mm in height and 530 mm in width must be provided. When working in the workplace in a sitting position it is important to observe the proportions between a table and a chair. Adjustable parameters of the height of a working surface, seat and foot space should be selected according to the nomogram, depending on the height of a worker. If the working surface height is not regulated, it is set for a worker with the height of 1 m 80 cm. The optimum working posture for lower height workers is achieved by increasing the height of a work chair and using a height-adjustable footrest with a width of at least 300 mm and a length of at least 400 mm. The surface of the stand must be grooved and have a bead 10 mm high on the front edge.

In those cases where it is not possible to adjust the height of a working surface and the height of a footrest, it is allowed to design and manufacture equipment with non-regulated workplace parameters. In this case, the numerical values of these parameters are determined by tables No. 46, 47.

**Table No. 46.** Working surface height (mm) when arranging a workplace for working in a standing position.

Work category by heaviness	For women	For men	For women and men
Easy	990	1060	1025
Medium	930	980	955
Hard	870	920	895

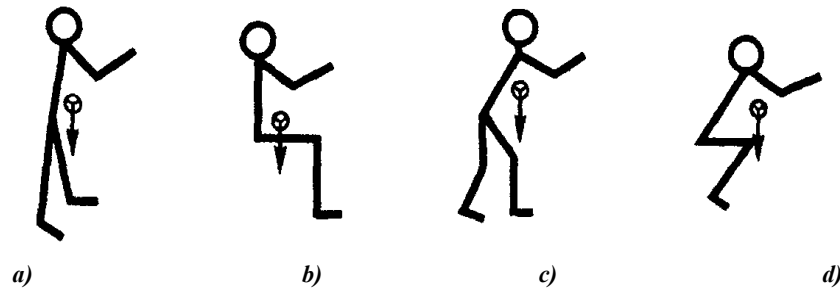
**Table No. 47.** Working surface height (mm) when arranging a workplace for working in a sitting position.

Work name	For women	For men	For women and men
Very delicate visual work (assembly of very small components)	930	1020	975
Fine work (installation of small parts, machining operations requiring precision, etc.)	835	905	870
Easy works (installation of bigger components, office work, machining operations not requiring high precision, etc.)	700	750	725
Easy assembly works (assembly of bigger components)	630	680	655

Working in a standing position creates maximum opportunities for viewing and free movements. At the same time, the standing working posture requires high energy costs and leads to rapid fatigue. Longtime work in the vertical position can sometimes be accompanied by pathology of the lower extremities in the form of

varicose veins, thrombophlebitis, edema of the lower extremities, etc. Work in a sitting posture is less fatigable and more rational. However, in this case congestive phenomena in the small pelvic organs, obstruction of the circulation and respiration organs can occur. Longtime work in a sitting position is also accompanied by static tension of the muscles of the neck, shoulder girdle and back. Proceeding from the foregoing, it is important, when compatible with technology and production conditions, to combine the performance of work both standing and sitting. The choice of an optimal working posture should take place in such a way that the workers could change the position of the body at their discretion.

The working area should be organized and the controls should be arranged in such a way that in the working posture the projection of the human body gravity center is located within the area of its support. Otherwise, the position of the human body will be unstable and require significant muscle efforts, which can lead to the locomotor apparatus diseases, fatigue and injuries (Figure No.29).



**Figure No. 29.** Scheme of biomechanical analysis of the working posture with stable (a and b) and unstable (c and d) postures: a, c - standing; b, d - sitting.

To evaluate the degree of optimality of the working posture, a photogrammetric method of research is used, allowing to create schematic diagrams of sitting and standing working postures. Having constructed the diagram and compared the obtained angular values with the optimal ones, one makes conclusions about the rationality of

a working posture and gives recommendations on its optimization (changing the height of a working surface, seat, leg space, etc.). One ought to bear in mind that the main principle of ergonomic evaluation of a workplace is to determine its compliance with anthropometric and psychophysiological characteristics of a human.

**Ergonomic requirements to controls and display devices.**

Controls of the most diverse mechanisms must be easily recognizable, accessible and provide promptness of impact. When designing and placing the controls in the body field, physiological features of the human motor apparatus and his/her anthropometric characteristics must be taken into account.

Efforts necessary for control actions must be established taking into account the way the control is moved, frequencies of its use and, in some cases, taking into account the duration of the continuous impact on the controls, speed of the control action and position of a human person in the control process. In this case, the efforts applied to the controls must be compatible with the biomechanical parameters of the human. Too much effort can lead to fatigue and overfatigue.

The driving elements of the controls for hands must have a shape that ensures a reliable grip by hands (ball-shaped or pear-shaped, conic, spindle-shaped or cylindrical, etc.). The diameter of the handles with a rounded shape (spherical) for gripping with fingers is taken equal to 10-40 mm, and for gripping with a wrist- 35-50 mm, with an elongated shape (spindle-shaped) - 10-30 and 20-40 mm respectively. Foot control is less precise than manual, so it should be used for unloading hands for control actions of small precision. The shape and size of the pedals and other driving elements of the controls should be such that the legs do not slip. The pressure force on the pedals must not exceed the recommended levels. When controlling by a foot, the pedal movement should be no more than 80 mm, the width of the supporting surface - no less than 60 mm.

The controls should be placed taking into account the heaviness of work, easy reach zones and optimal areas of the body field. The controls used up to five times per shift are allowed to be located outside the reach of the body field. Emergency controls

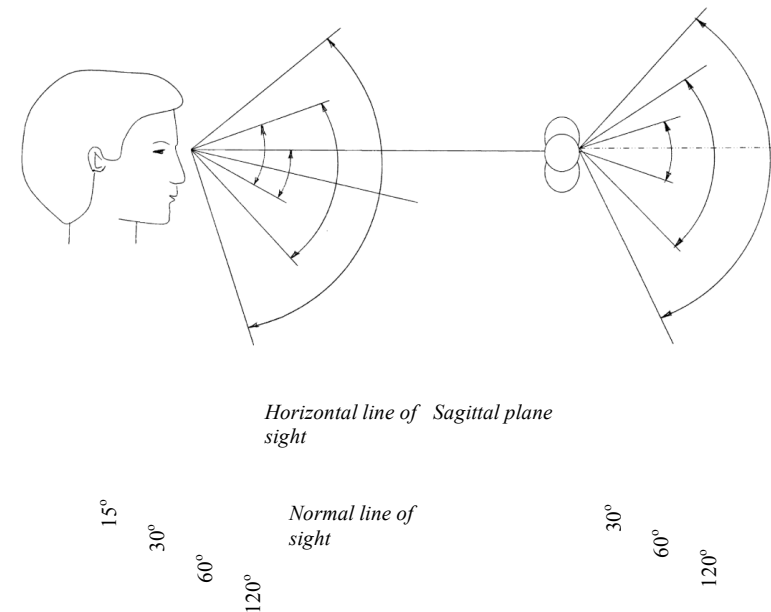
should be located only within this zone. In this case, special means of identifying and preventing their accidental and spontaneous switching-on are provided for.

When working with both hands, the controls are placed so as to avoid crossing of hands. To denote the functional purpose of controls, inscriptions and symbols are used. They should be located on the elements of the workplace structures in the immediate vicinity of the controls or on their driving elements.

Proper placement and choice of means of information displays are important in the workplace organization. The main part of the information should be visual. Acoustic signals should be used as emergency and warning signals and in those cases when the visual channel is overloaded with information, visibility is limited, the spatial extent is great, and the activity of a worker is monotonous. The level of signal intensity must be 10 decibels higher than the intensity of industrial noise.

When placing the information displays, the following requirements must be observed: all devices must be in the field of vision, and the most important and requiring high accuracy of perception - in the center of this field; the devices must be grouped according by the functions to be performed, taking into account the sequence of their use, and also under any specific principle, for example, by the position of arrows (in this case, the time for monitoring and decoding of information is reduced); the functional correspondence between a flowing process and a reading must be observed. Scales should be made horizontal, as reports on vertical scales cause more errors.

Very frequently used information displays should be placed in the vertical plane at an angle of + (-) 15° to the normal line of sight and in the horizontal plane at an angle of + (-) 15° to the sagittal plane (Figure No.30).



**Picture № 30.** Zones of visual observation  
a - vertical plane; b - horizontal plane

Frequently used information displays can be placed in the vertical plane at an angle of + (-) 30° to the normal line of sight and in the horizontal plane at an angle of + (-) 30° to the sagittal plane. Rarely used information displays are located at angles of + (-) 60° to both planes.

One ought to bear in mind that the information zones of the human visual field are determined by the fields of vision (field of clear vision, field of view, etc.), whose dimensions are expressed by visual angles. In this case, the visual information devices of the operator, depending on the frequency of their use, should also be located in the corresponding zones of the human visual field. Frequent use of devices predetermines the need for their location within the optimal viewing angles, and rare use - within the maximum viewing angles.



Organization and equipping of workplaces is designed taking into account the professions, number of responsible persons, level of specialization, mechanization and automation of technological processes, number of equipment serviced, etc. Systems and forms of servicing the workplaces (centralized, decentralized or mixed, by functions and personnel, etc.) are regulated by technological, technical and organizational forms approved in accordance with the established procedure.

GOST 12.2.049-80; GOST 12.2.032-78 and GOST 12.2.033-78 set the safety requirements for the operative parts and components of the equipment design, devices for installing the subject of labor and tools; safety requirements for engines of machines; safety requirements for the organizational and technological equipment. General safety requirements for the production equipment, workplaces, control system, protective equipment included in the design and signaling devices, as well as safety requirements for production processes, premises, sites, materials, equipment placement and protective equipment are presented in GOST 12.2.003-91 Occupational safety standards system.

Considering the psychophysiological features of the development of fatigue and overfatigue, the prevention of the emergence of these conditions can be achieved through the wide use of the most diverse socio-economic, physiological-biochemical, psychological, technical and other kinds of activities. In the production environment besides occupational hygiene and physiology, ergonomics, these issues are covered by technical aesthetics, engineering psychology and scientific organization of labor.

Requirements of *technical aesthetics* are realized by means of the design (styling design of equipment), its color scheme, graphic media design, designing of overalls and footwear. At the same time, conditions for optimal visual loads and harmony in the emotional content of labor processes are created, the least injury risk and minimal harmful psychological effects of the labor process are ensured.

In the process of styling design of the color and texture characteristics of the equipment, it is necessary to follow the principles of their conformity to the purpose of the equipment and taking into account the psychophysiological effect of the color and texture characteristics on the operator (Table No.48).

**Table No. 48.** Effect of color on the human condition.

Color	Arterial pressure	Pulse	Breathing rate	Response rate	Emotions	Performance capability
Red	Increases	Becomes more frequent	Accelerates	Accelerates	Excites. Stimulates	In the first 20 minutes, it rises to 20%, and then decreases
Orange	Insignificantly increases	Becomes insignificantly more frequent	Insignificantly accelerates	Slightly accelerates	Excites, invigorates	Same, but less pronounced
Yellow	Does not change	Does not change	Does not change	Does not change	Balances	Does not change significantly
Green	Does no change	Does not change	Does not change	Does not change	Balances	Slightly increases
Light blue	Slightly changes	Slightly decreases	Slight reduces	Does not change significantly	Calms down	
Blue	Decreases	Slows down	Slows down	Slightly slows down	Calms down, slightly cools down	Increases
Violet	Decreases	Slows down	Slows down	Expressly slows down	Depresses	Gradually decreases

The composition-color solution should facilitate the orientation of a worker in the functional properties of the equipment and conditions of its maintenance. To compensate for color fatigue, it is recommended to use complementary colors or color triads. The color of the treatment zone surface should be chosen as the primary color, which, if possible, should be approximated to the physiologically optimal regions of the spectrum, to the average levels of lightness and saturation.

*Engineering psychology*, which studies the connection between the structure of control panels and peculiarities of perception and processing of information by operators, has a goal of designing and constructing control panels taking into account the capacity of human analyzer systems. It is very important that the flow of incoming signals does not exceed the psychophysiological capabilities of human analyzer systems.

*Scientific labor organization* service engaged in the development and implementation of measures aimed at optimizing the labor process is based on the most advanced achievements of hygienic, physiological and technical scientific disciplines. The use of the advanced experience allows not only to effectively organize equipment and people in a single production process, but also to ensure the most rational use of material and labor resources, and, as a result, to increase labor productivity.

#### **6.4. Classes of labor conditions**

Currently the differentiation of the nature and conditions of labor of a working person is carried out on the basis of trauma safety, total energy expenditure of the body and, according to the hygienic criteria for assessing the work environment factors, heaviness and intensity of the work process, hygienic classification of labor conditions by hazard and danger indicators.

##### **6.4.1. Classification of labor conditions by trauma safety**

The class of workplace trauma safety is established in accordance with the following classification on the basis of the "Rules for Conducting Attestation of Production Facilities by Working Conditions" approved by the Ministry of Labor and Social Protection of the Population of the Republic of Kazakhstan as of 03.11.2004 No.251.

*Trauma safety* is the compliance of workplaces with the requirements of labor protection, excluding injuries of workers in the conditions regulated by legal acts on labor protection. Working conditions at trauma safety are divided into three classes: 1, 2 and 3.

Class 1 (optimal conditions): full compliance of equipment and tools with standards and rules (regulatory legal acts). Security facilities are installed and fixed.

Types of briefing and training are made in accordance with the requirements; the equipment is in good order.

Class 2 (permissible conditions): security facilities are damaged and defective but do not reduce their protective functions (partial contamination of the signal color, loosening of individual fasteners, etc.).

Class 3 (dangerous conditions): damaged, defective or missing means of protection of working elements and gears provided for by the equipment design (fences, interlocks, signaling devices, etc.), the tool is defective. There are no instructions on labor protection, or the existing instructions are drawn up without taking into account the corresponding requirements, the conditions for their revision are violated. There are no means of training labor safety, and the available ones are of poor quality and the conditions for their revision are violated. There are no means of training on labor safety (rules, training and controlling programs, training aids, etc.), or the available means are poorly designed and the conditions of their revision are violated.

The main objects of assessing the safety of workplaces are:

- production equipment;
- appliances and tools;
- provision with the means of training and briefing.

The evaluation of production equipment, devices and tools is carried out on the basis of current and applicable regulatory acts on health and safety (state and industry standards, occupational safety rules, standard instructions on labor protection, etc.).

Procedure of evaluation of trauma safety of workplaces:

- availability, correctness of maintenance and compliance with the requirements of technological and operational

documentation in terms of ensuring labor safety (periodic inspections, surveys, etc.) are checked;

- for evaluation of each type of workplace, a list of regulatory requirements for the factor of trauma safety is drawn up on the basis of the existing regulatory legal acts on labor safety or documentation for the workplace (the list includes the requirements that correspond to the signs of trauma safety);

- guided by the list, evaluation of the injury safety by checking the technical documentation, actual condition of the equipment, appliances and tools, as well as the quality of the briefing and training means.

The evaluation of trauma safety is carried out by checking the conformity of production equipment, appliances and tools, as well as training and briefing means to the requirements of regulatory legal acts. Evaluation of the trauma safety of the workplace is documented by a protocol, which summarizes conclusions, and also indicates which items of norms, rules and standards do not correspond to the evaluated workplace.

#### **6.4.2. Works by heaviness on the basis of total energy expenditures of the body**

The level of energy expenditures of the human when performing various forms of activity serves as a criterion of heaviness and intensity of the work performed, is of great importance for optimizing working conditions and its rational organization.

The body need in energy is mainly determined by the level of metabolic processes aimed at maintaining the constancy of the internal environment of the organism and the self-renewal of its morphological structures, expenditure of energy on labor activity, adaptation of the body to changing environmental conditions, and active rest. An objective indicator of energy consumption for a certain period of time is the amount of total energy expenditure of the organism for the same period. The total energy expenditure consists

of the expenditure of energy on the basic metabolism, muscle activity and the specific dynamic effect of food.

*Basic metabolism* is the minimum energy metabolism necessary to maintain the life of the organism in a state of complete rest, with the exclusion of all internal and external influences that can enhance the level of metabolic processes.

The rate of the basic metabolism depends mainly on age, height, body weight and sex. As an integral indicator of the intensity of oxidation-reduction processes in tissues at rest, the basic metabolism depends to a certain extent on the state of internal organs and external influences on the organism. It can change with insufficient or excessive nutrition, effects of climatic factors on the body, hypoxia, endocrine gland dysfunction and in diseases if they are accompanied by a febrile condition.

Muscular activity has the strongest impact on the energy metabolism. Even while keeping awake, the energy metabolism always exceeds the amount of basic metabolism, and the degree of energy expenditure increase depends, first of all, on the nature of the work performed and level of motor activity that are related to muscle activity and determine the intensity of the organism functioning. The heaviness and intensity of labor activity, the conditions of the external environment (temperature, humidity, air movement, etc.) in which it is performed, the training of an individual is of importance.

Energy expenditures vary depending on the work posture. So, with a sitting working posture the energy expenditures exceed the level of basic metabolism by 5-10%; in standing posture - by 10-25%; with a forced uncomfortable posture - by 40-50%. While performing intensive intellectual work, the brain's need for energy is 15-20% of the total metabolism in the body. The increase in total energy expenditures for mental work is determined by the degree of neuro-emotional tension. The daily energy expenditure for mental work increases by 48% when reading aloud sitting, 90% - when reading a lecture, 90-100% for computer operators. In addition, the brain is prone to inertia, since after the cessation of work the thought process continues, which leads to more fatigue and exhaustion of the central nervous system than while working physically.

The duration and intensity of the increase in energy metabolism can vary considerably depending on the individual characteristics of the organism, as well as the quantity and quality of the food consumed. Increase in energy metabolism at the intake of various food substances is called a *specific dynamic action (SDA)* of food. SDA is a complex reflex process, during which food decay products have a direct effect on the cellular metabolism and (or) are accompanied by a change in the functional activity of the gastrointestinal tract.

The categorization of working groups of the population by energy expenditures on easy physical work, medium physical work and heavy physical work is carried out according to SanPiN "Hygienic requirements for the microclimate of industrial premises" approved by the Ministry of Health of the RK on July 14, 2005, No. 355 (Table No.49).

**Table No. 49.** Works by heaviness on the basis of general energy expenditures of the body.

Category	Labor conditions
<b>I</b>	<i>Light physical works</i>
<b>I a</b>	Activities, which include works that performed in a sitting posture and not requiring physical stress and during which the energy consumption is up to 120 kcal/h
<b>I b</b>	Activities, which include works that are performed in a sitting, standing posture or that are associated with walking and accompanied by some physical stress, the energy consumption is from 120 to 150 kcal/h
<b>II</b>	<i>Medium physical works</i>
<b>II a</b>	Activities, which include works related to walking, moving small (up to 1 kg) items and objects in a standing or sitting position and requiring a certain physical strain. The energy consumption is from 150 to 200 kcal/h
<b>II b</b>	Activities, which include works that are performed standing, are associated with walking, carrying small (up to 10 kg) weights and are accompanied by moderate physical stress. The energy consumption is from 200 to 250 kcal/h

	<i>Hard physical works</i>
<b>III</b>	Activities, which include works that are associated with the constant movement, movements and transport of significant (more than 10 kg) weights and requiring great physical effort. Energy consumption exceeds 250 kcal/h

Knowledge of energy expenditures is necessary not only to identify groups of labor intensity, but also to determine the energy needs of people of different ages and professions in the specific conditions of their life and work. Daily energy inputs, and consequently, the need for energy can be considered as consisting of energy consumption for productive activities, work during off-duty hours and sleep. Data on the energy needs of a "standard" male and a "standard" female can be used as a starting point for calculating the energy needs of men and women of different professional and age groups. In such calculations, corrections are also used that take into account the influence on the need for energy of such factors as body weight, age, sex, the influence of production conditions and environmental factors.

#### 6.4.3. Types of working conditions according to the level of working-environment and workflow hazards

Optimally, in service of ultimate aims, any type of professional activity should be accompanied by the highest labour performance and productivity in the absence of signs of health problem in workers. Provision of these conditions is based on scientifically developed health standards, according to which the working conditions are divided into classes by the level of hazard.

*Hygienic criteria* are indicators characterizing the level of departure of working environment and workflow factors from the existing health standards. Classification of working conditions, developed by the Research Institute of Occupational Health, RAMS, is based on the principle of differentiation of these deviations which give the right to assign working conditions to a certain hazard class ("Hygienic criteria for assessing working conditions according to the

harmful indicators and hazard factors of the working environment, severity and stress level of workflow” (R.2.2.755-99 dated 23.04.1999, ADZ RK No. 1.04.001.2000).

Based on the level of departure of actual working environment and workflow factors from hygienic standards, the working conditions are roughly divided into 4 classes according to their level of hazard: optimal, permissible, harmful and dangerous.

*Optimal working conditions* (1st class) are the conditions under which the health of the employee is preserved and prerequisites are created to maintain a high level of working efficiency. Optimal standards of working environment factors are established for microclimatic parameters and work load factors. For other factors, optimal working conditions include such working conditions that exclude harmful factors or under which harmful factors do not exceed the levels adopted as safe for the population.

*Permissible working conditions* (2<sup>nd</sup> class) are characterized by such levels of environmental and workflow factors that do not exceed the established health standards for workplaces, and possible changes in the functional state of the body are restored during a scheduled rest or by the beginning of the next shift and do not have adverse effects in the near and long-term period on the health of workers and their children. Permissible working conditions are roughly qualified as safe.

*Harmful working conditions* (3<sup>rd</sup> class) are characterized by the presence of harmful factors which exceed the health standards and have adverse effect on the worker’s body and (or) his/her offspring.

According to excess of health standards and severity of changes in workers’ body, the harmful working conditions are roughly divided into 4 levels of hazard:

1 level of 3rd class (3.1) - working conditions are characterized by such departure of harmful factors from health standards that cause functional changes which generally take a longer period (than by the beginning of the next shift) of isolation from the harmful factors for restoration and increase the risk of damage to health;

2 level of 3 class (3.2) - levels of harmful factors that cause persistent functional changes, leading in most cases to an increase in the work-related morbidity (which can be manifested by an increase in the incidence of morbidity with temporary disability and, above all, diseases that reflect the state of organs and systems most vulnerable to these factors), occurrence of initial signs or mild forms of occupational diseases (without loss of labour capacity) arising from the prolonged exposure (often after 15 years or more);

3 level of 3 class (3.3) - working conditions characterized by such levels of working environment factors, the impact of which generally leads to the development of occupational diseases of mild and moderate severity (with loss of professional capacity for work) in the period of work, the growth of chronic (professionally conditioned) pathology;

4 level of 3 class (3.4) - working conditions under which severe forms of occupational diseases can occur (with loss of general capacity for work), there is a significant increase in the number of chronic illnesses and high incidence rates with temporary disability.

Dangerous (extreme) working conditions (4 class) are characterized by the levels of working environment factors, the impact of which during the working shift (or part thereof) poses a threat to life, a high risk of development of acute occupational injuries, incl. heavy forms.

Tables 50-62 show classes of working conditions depending on the content of microorganisms-producers in the air of the working zone, chemical substances and physical factors, aerosols; Classification of labor conditions by microclimate indicators, light environment parameters, exposure to non-ionizing electromagnetic radiation and classification of working conditions by indicators of severity and intensity of the workflow is also presented.

**Table No.50.** Classes of working conditions depending on the content of harmful chemical substances in the air of working zone (MPC exceedance, times).

Harmful substances	Class of working conditions					
	Permissible	Harmful				Dangerous
	2	3.1	3.2	3.3	3.4	4
Harmful substances of 1-2 class of hazard, excluding listed below	≤ MPC	1,1-3,0	3,1-6,0	6,1-10,0	10,1-20,0	> 20,0
Harmful substances of 3-4 class of hazard, excluding listed below	≤ MPC	1,1-3,0	3,1-10,0	> 10,0		
Substances, dangerous for development of acute intoxication: with high-directional mechanism of action of irritant effect	≤ MPC	1,1-2,0	2,1-4,0	4,1-6,0	6,1-10,0	> 10,0
Cancerogenes	≤ MPC	1,1-3,0	3,1-6,0	6,1-10,0	> 10,0	
Allergens	≤ MPC		1,1-3,0	3,1-10,0	> 10,0	
Antitumor medicines, hormones (estrogens)	≤ MPC				+	
Narcotic analgesics	≤ MPC		+			

**Table No. 51.** Classes of working conditions depending on the content of microorganisms-producers in the air of working area

Harmful substances	Class of working conditions					
	Permissible	Harmful				Dangerous
	2	3.1	3.2	3.3	3.4	4
microorganisms-producers, medicines, containing living cells and spores of microorganisms	≤ MPC	1,1-3,0	3,1-10,0	> 10,0		
Pathogenic microorganisms						+
				+		

**Table No. 52.** Classes of working conditions depending on the content of strongly fibrogenic aerosols in the air of working area and dust loads on respiratory organs (rate of excess of MPC and CDL).

Harmful substances	Class of working conditions					
	Permissible	Harmful				Dangerous (extreme)
	2	3.1	3.2	3.3	3.4	4
Excess of MPC, times						
Dust concentration	≤ MPC	1,1-2,0	2,1-5,0	5,1-10,0	> 10,0	
Excess of CDL, times						
Dust load (DL)	≤ CDL	1,1-2,0	2,1-5,0	5,1-10,0	> 10,0	
Dust load for strongly fibrogenic dusts (MPC ≤ 1 mg/m <sup>3</sup> ), as well as for asbestos dusts	≤ CDL	1,1-1,5	1,6-3,0	3,1-5,0	> 5,0	

**Table No. 53.** Classes of working conditions depending on the level of noise, local and general vibration, infra- and ultrasound at the workplace

Indicator	Class of working conditions					
	Permissible	Harmful				Dangerous (extreme)
		2	3.1	3.2	3.3	
Excess of MPL up to ...						
Noise Equivalent sound level, dBA	≤ MPL	5	15	25	35	> 35
Local vibration Equivalent corrected vibration speed level, dB	≤ MPL	3	6	9	12	> 12
General vibration Equivalent corrected vibration speed level, dB	≤ MPL	6	12	18	24	> 24
Infrasound Total sound pressure level, dB Lin	≤ MPL	5	10	15	20	> 20
Airborne ultrasound Sound pressure levels in 1/3 octave bandwidth, dB	≤ MPL	10	20	30	40	> 40
Contact ultrasound Vibration speed level, dB	≤ MPL	5	10	15	20	> 20

**Table No. 54.** Classes of working conditions by microclimate indicators for production premises regardless of periods of the year and open areas in the warm period of the year.

Indicator	Class of working conditions					
	Optimal	Permissible	Harmful			Dangerous (Extreme)
Air temperature, °C	1 According to SanPin	2 According to SanPin	3.1	3.2	3.3	3.4 4
Air velocity, m/s	According to SanPin	According to SanPin	According to ETC-index (see table No. 55); According to air temperature for premises with cooling microclimate (see table No. 56)			According to ETC-index (see table No. 55); Taken into account as temperature correction during assessment of cooling microclimate (see table No. 56)
Air humidity, %	According to SanPin	According to SanPin	14-10	<10		
ETC(environment thermal capacity)-index, °C	According to table No. 55					
Thermal exposure, W/m <sup>2</sup>	According to SanPin	According to SanPin	1 001-1 500	1 501-2 000	2 001-2 500	2 501-2 800 > 2 800

**Table No. 55.** Classes of working conditions according to ETC-index ( $^{\circ}\text{C}$ ) for production premises with heating microclimate regardless of the period of the year and open areas in the warm period of the year.

Category of works	Total power consumption, $\text{W/m}^2$	Class of working conditions						
		Optimal	Permissible	Harmful				Dangerous (extreme)
				1 degree	2 degree	3 degree	4 degree	
1	2	3.1	3.2	3.3	3.4	4		
I a	68 (58-77)	22,2-26,4		26,5 - 26,6	26,7 - 27,4	27,5 - 28,6	28,7 - 31,0	> 31,0
I б	88 (78-97)	21,5-25,8		25,9 - 26,1	26,2 - 26,9	27,0 - 27,9	28,0 - 30,3	> 30,3
II a	113 (98-129)	20,5-25,8		25,2 - 25,5	25,6 - 26,2	26,3 - 27,3	27,4 - 29,9	29,9
II б	145 (130-160)	19,5-23,9		24,0 - 24,2	24,3 - 25,0	25,1 - 26,4	26,5 - 29,1	> 29,1
III	177	18,0-21,8		21,9 - 22,2	22,3 - 23,4	23,5 - 25,7	25,8 - 27,9	> 27,9

**Table No. 56.** Class of working conditions according to the air temperature indicator ( $^{\circ}\text{C}$ , bottom boundary) during the work in production premises with cooling microclimate.

Category of works	Total power consumption, $\text{W/m}^2$	Class of working conditions						
		Optimal	Permissible	Harmful				Dangerous (extreme)
				1 degree	2 degree	3 degree	4 degree	
1	2	3.1	3.2	3.3	3.4	4		
I a	68 (58-77)	According to SanPin	According to SanPin	18	16	14	12	
I б	88 (78-97)	According to SanPin	According to SanPin	17	15	13	11	
II a	113 (98-129)	According to SanPin	According to SanPin	14	12	10	8	
II б	145 (130-160)	According to SanPin	According to SanPin	13	11	9	7	
III	177	According to SanPin	According to SanPin	12	10	8	6	

**Table No.57.** Classes of working conditions according to the air temperature indicator ( $^{\circ}\text{C}$ , bottom boundary) for open areas in the cold period of the year and in the cold (unheated) premises.

Climatic zone	Total thermal resistance of the clothing	Class of working conditions					
		Permissible	Harmful				Dangerous (extreme)
			1 degree	2 degree	3 degree	4 degree	
		2	3.1	3.2	3.3	3.4	4
I A	0,71	-30	-36	-38,5	-40,8	-60	< -60,0
I Б	0,82	-38	-46,2	-48,9	-54,4	-70	< -70,0
II	0,61	-23	-29,4	-31,5	-35,7	-48	< -48,0
III	0,51	-15,9	-21,3	-23	-28	-37	< -37,0



**Table No.58.** Classes of working conditions depending on the light environment parameters of the premises

Factor, indicator	Class of working conditions				
	Permissible	Harmful- 3			
		1 degree	2 degree	3 degree	4 degree
	2	3.1	3.2	3.3	3.4
Natural illumination: Daylight factor (DF, %)	$\geq 0,6$	0,1-0,6	< 0,1		
Artificial illumination:					
Illumination of working area (E, Лк) for categories of visual works:	I-IV, VII	$E_H$	$0,5 E_H < E_H$	$< 0,5 E_H$	
	V, VI, VIII-XIV	$E_H$	$< E_H$		
Blindness measures (P, rel. units)	$P_H$	$> P_H$			
Reflected glare	absence	presence			
Percent flicker (КЛ, %)	$K_{ЛH}$	$> K_{ЛH}$			
Brightness (L, кд/м <sup>2</sup> )	$L_H$	$> L_H$			
Irregularity in brightness distribution (C, rel. units)	$C_H$	$> C_H$			

**Table No. 59.** Classes of working conditions in the case of effect of non-ionizing electromagnetic emissions (electromagnetic fields and emissions)

Factor	Class of working conditions						
	Optimal	Permissible	Harmful				Dangerous (extreme)
			1 degree	2 degree	3 degree	4 degree	
	1	2	3.1	3.2	3.3	3.4	4
1	2	3	4	5	6	7	8
Excess of MPL (times)							
Geomagnetical field	Natural background	$\leq TPL$	$\leq 5$	$\leq 10$	$\leq 50$	$> 50$	
Electrostatic field	Natural background	$\leq MPL$	$\leq 3$	$\leq 5$	$\leq 10$	$> 10$	
Constant magnetic field	Natural background	$\leq MPL$	$\leq 5$	$\leq 10$	$\leq 100$	$> 100$	
Electrical fields of industrial frequency (50 Hz)	Natural background	$\leq MPL$	$\leq 5$	$\leq 10$	$\leq 50$	$> 50$	$> 40$
Magnetic fields of industrial frequency (50 Hz)	Natural background	$\leq MPL$	$\leq 5$	$\leq 10$	$\leq 50$	$> 50$	
EMI generated by VDT and PC		$\leq MPL$	$\leq 5$	$\leq 10$	$\leq 50$	$> 50$	
EMI of radio frequency band:							
0,01-0,03 MHz	Natural background	$\leq MPL$	$\leq 3$	$\leq 5$	$\leq 10$	$> 10$	
0,03-3,0 MHz	Natural background	$\leq MPL$	$\leq 3$	$\leq 5$	$\leq 10$	$> 10$	
3,0-30,0 MHz	Natural background	$\leq MPL$	$\leq 3$	$\leq 5$	$\leq 10$	$> 10$	
30,0-300,0 MHz	Natural background	$\leq MPL$	$\leq 3$	$\leq 5$	$\leq 10$	$> 10$	$> 50$
300,0-МГц-300,0 GHz	Natural background	$\leq MPL$	$\leq 3$	$\leq 5$	$\leq 10$	$> 10$	$> 50$

**Table No. 61.** Classes of working conditions according to indicators of severity of workflow

No.	Indicators of severity of workflow	Class of working conditions				
		Optimal (Low physical activity)	Permissible (medium physical activity)	Harmful (hard work)		
				1 degree 3.1	2 degree 3.2	3 degree 3.3
1	2	3	4	5	6	7
1.	Physical dynamic activity, expressed in the units of external mechanical work per shift, kg m					
1.1.	In the case of regional load (with engagement of mostly hand and shoulder girdle muscles)during moving the loads at a distance of up to 1 m:					
	For men	Up to 2 500	Up to 5 000	Up to 7 000	Up to 9 000	More than 9000
	For women	Up to 1 500	Up to 3 000	Up to 4 000	Up to 5 000	More than 5500
1.2.	In the case of total load (with engagement of hand, body and legs muscles):					
	During moving the loads at a distance of 1 - 5 m					
	For men	Up to 12500	Up to 25000	Up to 35000	Up to 45000	More than 45000
	For women	Up to 7500	Up to 15000	Up to 25000	Up to 27000	More than 27000

**Table No. 60.** Classes of working conditions in the case of effect of non-ionizing electromagnetic emissions of optical band (laser, ultraviolet).

Factor	Class of working conditions	Class of working conditions						
		Optimal	Permissible	Harmful				Dangerous (extreme)
				1 degree	2 degree	3 degree	4 degree	
1	2	3.1	3.2	3.3	3.4	4		
Laser emission	-	<- MPL <sub>1</sub>	<- MPL <sub>2</sub>	< 10 <sup>2</sup> MPL <sub>2</sub>	< 10 <sup>2</sup> MPL <sub>2</sub>	< 10 <sup>3</sup> MPL <sub>2</sub>	< 10 <sup>3</sup> MPL <sub>2</sub>	
In the case of presence of production sources YΦ-A, YΦ-B, YΦ-C, Bt/M <sup>2</sup>	IIIII	> IIIII						
Ultraviolet emission	In the case of presence of preventive UI sources (YΦ-A), MW/m <sup>2</sup>	9.45	< 9					

1	2	3	4	5	6	7
	During moving the load at a distance of not more than 5 m					
	For men	Up to 24000	Up to 46000	Up to 70000	Up to 90000	More than 90000
	For women	Up to 14000	Up to 28000	Up to 40000	Up to 55000	More than 55000
2.	The weight of goods lifted and moved manually, kg					
2.1.	Lifting and moving (one-time) the weights with interchange with other work (up to 2 times per hour)					
	For men	Up to 15	Up to 30	More than 30		
	For women	Up to 5	Up to 10	More than 10		
2.2.	Lifting and moving (one-time) the weights constantly during the shift					
	For men	Up to 5	Up to 15	Up to 30	More than 30	
	For women	Up to 3	Up to 7	More than 7		
2.3.	Total weight of goods moved within each hour of the shift:					
	From working surface					
	From men	–	Up to 870	More than 870		
	For women		Up to 350	More than 350		

1	2	3	4	5	6	7
	From floor					
	For men	–	Up to 435	More than 435		
	For women	–	Up to 175	More than 175		
3.	Stereotype labor movements (quantity per shift)					
3.1.	In the case of local load (with engagement of hand muscles and fingers)	Up to 20000	Up to 40000	Up to 60000	More than 60000	
3.2.	In the case of regional load (with engagement of mostly hand and shoulder girdle muscles)	Up to 10000	Up to 20000	Up to 30000	More than 30000	
4.	Static load 1: value of static load per shift with holding the weight and application of efforts, kg s:					
	With one hand	Up to 18000	Up to 36000	Up to 70000	More than 70000	
	With tow hands	Up to 36000	Up to 70000	Up to 140000	More than 140000	
	With engagement of body and legs muscles	Up to 43000	Up to 100000	Up to 200000	More than 200000	
5.	Working posture	Free, comfortable posture (change of posture «seating-	Periodical stay in uncomfortable fixed posture (impossibility to change the relative	Periodical stay in uncomfortable fixed posture up to	Periodical stay in uncomfortable, fixed posture up to	

1	2	3	4	5	6	7
		standing» at the discretion of the employee )	position of different parts of the body with respect to each other) up to 25% of shift time	50% of shift time; stay in constrained posture (on knees, on hunkers etc) up to 25% of shift time	50% of shift time; stay in constrained posture (on knees, on hunkers etc) up to 25% of shift time	
6.	Body bends (quantity per shift)	Up to 50 times per shift	Constrained bends more than 300, 51-100 times per shift	Constrained bends more than 300, 101-300 times per shift	Constrained bends more than 300, above 300 times per shift	
7.	Spatial movement (movements, caused by work activity during the shift), km	Up to 4	Up to 10	Up to 15	More than 15	

<sup>1</sup> Only for men; for women, values lower than the specified values by 40 % shall be accepted.

**Table No. 62.** Classes of working conditions according to the severity of workflow

No.	Severity of workflow	Class of working conditions				
		Optimal (Low physical activity)	Permissible (medium physical activity)	Harmful (heavy goods)		
				1 degree 3.1	2 degree 3.2	3 degree 3.3
1	2	3	4	5	6	7
1.	Intellectual loads					
1.1.	Job content	There is no need to take decisions	Fulfillment of simple alternative tasks according to the instruction	Fulfillment of complex tasks with selection according to known algorithms (work according to the series of instructions)	Heuristic (creative) activity that require solving the complex tasks with absence of algorithm	

1	2	3	4	5	6	7
1.2.	Signals perception (information) and their assessment	Signals perception, but actions correction is not required	Signals perception with subsequent correction of actions and operations	Signals perception with subsequent comparison of actual values with nominal values. Final assessment of actual values of parameters	Signals perception with subsequent comprehensive assessment of interrelated parameters. Comprehensive assessment of operating activities	
1.3.	Task complexity	Processing and fulfillment of tasks	Processing, fulfillment of task and its verification	Processing, verification and control over fulfillment of the task	Control and preliminary work on allocation of tasks to other persons	

1	2	3	4	5	6	7
1.4.	The nature of work performed	Work according to individual plan	Work according to established schedule with possible correction during execution of activities	Work under time shortage conditions	Work under time and information shortage conditions with increased responsibility for final outcome	
2.	Sensory loads					
2.1.	Duration of concentrated supervision (in % of shift time)	Up to 25%	26-50%	51-75%	More than 75%	
2.2.	Density of signals (light, sound) and messages in average within the 1 hour of work	Up to 75	75-175	176-300	More than 300	
2.3.	Number of production objects of simultaneous supervision	Up to 5	6-10	11-25	More than 25	
2.4.	Load on visual analyzer					

1	2	3	4	5	6	7
2.4.1.	Size of object of distinction (with a distance from eyes of the employee to the object of distinction - 0,5 m), mm with duration of concentrated supervision (% of shift time)	More than 5 mm	5-1,1 mm more than 50% of time 1-0,3 mm up to 50% of the time, less than 0,3 mm up to 25% of time	1-0,3 mm More than 50% of time Less than 0,3 mm Up to 25-50% of time	Less than 0,3 mm more than 50% of time	
2.4.2.	Working with optical equipments (microscopes, lenses etc.) with duration of concentrated supervision (% of shift time)	25%	26-50%	51-75%	More than 75%	
2.4.3	Supervision of screens of visual display terminals (hours per shift)	Up to 2	2-3	3-4	More than 4	

1	2	3	4	5	6	7
2.5.	Load on acoustic analyzer (for operational reason of speech perception for differential signals)	Intelligibility of words and signals from 100 to 90%	Intelligibility of words and signals from 90 to 70%	Intelligibility of words and signals from 70 to 50%	Intelligibility of words and signals less than 50%	
3.	Emotional load					
3.1.	Degree of responsibility. Significance of error	Bears responsibility for fulfillment of individual elements of the task. Involves additional efforts of the employee	Bears responsibility for functional quality of the auxiliary works (tasks). Involves additional efforts of the higher management (crew chief, foreman etc.)	Bears responsibility for functional quality of auxiliary works (tasks). Involves corrections with the use of additional efforts of the all staff members (group, crew etc.)	Bears responsibility for functional quality of final product, work (task). Involves damage to the equipment, stoppage of industrial process and arises the probability of hazard to life.	

1	2	3	4	5	6	7
3.2.	The level of hazard to own life	Excluded	–	–	Probable	
3.3.	The Level of hazard to safety of other persons	Excluded	–	–	Possible	
4.	Routine loads					
4.1.	Number of elements (actions), necessary for fulfillment of the simple task or in repeated operations	More than 10	9-6	5-3	Less than 3	
4.2.	Duration (in sec) of fulfillment of simple production tasks or repeated operations	More than 100	100-25	24-10	Less than 10	
5.	Mode of working					
5.1.	Actual duration of labour day	6-7 hours	8-9 hours	10-12 hours	More than 12 hours	
5.2.	Shift-working arrangements	Single-shift work (without night shift)	Two-shift work (without night shift)	Three-shift work (night shift work)	Irregular shift work with night shift work	

## Chapter 7 CONCEPT OF OCCUPATIONAL DISEASES

### 7.1. Etiology of Occupational Diseases, Classification.

**Occupational diseases** are the diseases caused by the influence of harmful factors of the workspace environment and the labor process. Clinical discipline that studies the issues of etiology, pathogenesis, clinical pattern, diagnosis, treatment and prevention of occupational diseases is the **occupational pathology**. Occupational pathology, being an independent clinical discipline, forms the basis of occupational medicine and is at the intersection of the hygienic, clinical, social and economic sciences.

At present, fundamental problems of occupational pathology concerning the definition of the structure of occupational diseases, the definition of patterns of their pathogenesis and pathomorphosis, as well as diagnosis and treatment are solved. A distinctive feature of occupational pathology is the awareness of the acting etiological factor, since it is the etiological principle to be the basis for the formulation of the diagnosis of occupational diseases. Clinical manifestations of this group of diseases often do not have specific symptoms, and only information on the conditions and nature of the employee's labor help establish the belonging of the pathology identified to an occupational one. Only some of the occupational diseases are characterized with a special symptom complex, due to the unique and specific clinical medical, radiography morphologic, functional, hematological, biochemical and immunological changes.

A generally accepted classification of occupational diseases does not exist, since the clinical pattern thereof is often polymorphic and is characterized with the involvement of many organs and systems in the pathological process. This group of diseases is characteristic with a lack of clearly expressed and system dynamics of changes in biochemical, immunological, histochemical and other kinds of changes. The grouping of occupational diseases by the

*etiological principle* is the most recognized one, with seven groups of occupational diseases highlighted:

- 1) *Chemical factors exposure-related diseases* (acute and chronic intoxications, as well as the consequences thereof, which occur with isolated and associated damage of various organs and systems);
- 2) *Industrial aerosols exposure-related diseases* (pneumoconiosis - silicosis, silicatosis, heavy-metal coniosis, dust diseases of electric welders and gas cutters, grinders, emery producers, etc.);
- 3) *Physical factors exposure-related diseases* (vibration disease; diseases associated with exposure to contact ultrasound, - vegetal polyneuritis; cochlear neuritis-related hearing loss - noise disease; diseases associated with exposure to electromagnetic radiation and scattered laser radiation; radiation sickness; diseases associated with changes in atmospheric pressure - decompression sickness, acute hypoxia; diseases arising from unfavorable meteorological conditions - overheating, convulsive disease, obliterating endarteritis, vegetal sensitive polyneuritis);
- 4) *Diseases associated with physical overload and overstrain of individual organs and systems* (diseases of the peripheral nerves and muscles - neuritis, radiculopolyneuritis, vegetal sensory polyneuritis, cervicobrachial plexitis, vegetal myofasciitis, myofasciitis, musculoskeletal diseases - chronic tendovaginitis, stenosing ligamentitis, bursitis, epicondylitis of the shoulder, deforming arthrosis, coordinative neuroses - cheiropasm, other forms of functional dyskinesia, vocal apparatus diseases - phonasthenia, visual organ diseases - asthenopia and myopia);
- 5) *Biological factor-related diseases* (infectious and parasitic - tuberculosis, brucellosis, sap, anthrax, dysbacteriosis, candidiasis of the skin and mucous membranes, visceral candidiasis, etc.).

- 6) *Occupational allergic diseases* (conjunctivitis, upper respiratory tract diseases, bronchial asthma, dermatitis, eczema).
- 7) *Occupational neoplasms* (tumors of the skin, oral cavity, respiratory organs, liver, stomach, bones, kidneys, bladder, leukemia).

Isolation of allergic diseases and neoplasms into separate groups is fully justified, as this highlights the importance of such groups of diseases and attracts attention of practitioners.

There are acute and chronic occupational diseases.

**Acute occupational diseases (intoxications)** include the diseases developed suddenly, after a single (within one shift maximum) exposure to harmful and dangerous production factors, which intensity is much higher than the MPC or the MPL.

**The chronic occupational diseases (intoxications)** include such forms of diseases that arose as a result of prolonged exposure to harmful, dangerous substances and production factors. The immediate and long-term consequences of occupational diseases (for example, persistent organic changes in the central nervous system after carbon monoxide intoxication) should be referred to chronic diseases as well. It is necessary to consider the possibility of the development of occupational diseases after a long period of time after stopping work in contact with harmful, dangerous substance and production factor (late silicosis, berylliosis, bladder papilloma, etc.). Occupational diseases can also include diseases, which development may be influenced with occupational diseases as the background or risk factor (for example, lung cancer that develops against the asbestosis, silicosis or dust bronchitis).

The main document to determine whether this disease belongs to the occupational ones, to determine their relationship to the nature of the work or profession performed, to resolve issues of examination of work capacity, medical and labor rehabilitation, as well as to consider the issues related to compensation for damage caused to the employee by health damage is the List of Occupational Diseases and Intoxications approved by the Ministry of National Economy of the Republic of Kazakhstan (No. 440 dated 23.06.2015).



The List includes diseases that are caused solely or predominantly by the action of harmful, hazardous substances and production factors.

In modern clinical practice, the *system-organ principle* is widely used when grouping occupational diseases. The fact is that under the influence of harmful factors of the working environment, pathological changes (morphological, functional, biochemical, etc.) in organs and systems acquire similar features, which makes it possible to shape separate syndromes that determine the clinical pattern of various diseases and intoxications. Occupational pathology distinguishes the syndromes of the blood system damage (hypoplastic conditions, acute and chronic hemolytic anemia, hypersiderum anemia), hepatobiliary system (toxic hepatopathy), kidney and urinary tract (toxic nephropathy), nervous system (syndromes of vegetal sensory polyneuropathy, toxic encephalopathy, neurotic encephalopathy syndrome in the hyper- or hyposthenic option, a syndrome of vegetative-vascular dystonia), skin (contact and allergic dermatitis, eczema, toxicodermia).

Differentiation of these or other occupational diseases from the standpoint of the syndromic approach supplements the etiological principle of grouping and gives an opportunity to compose a holistic view of how a harmful production factor affects on the organism. At the same time, it becomes possible both to clarify the pathogenesis and clinical symptoms of the damage to certain organs and systems and to simplify the diagnosis of the disease and to select the most appropriate treatment regimen.

There are *production-related diseases* as well, which are not included in the List of Occupational Diseases and Intoxications, but the basis for occurrence thereof is directly related to the production and influence of adverse chemical, physical and biological factors on the body. As a rule, these diseases are polyetiologic and widely distributed among all population, however, they are found among people of certain occupations many times more often than others. An example of production-related diseases can be dust bronchitis, bronchial asthma in furriers and pharmacists, pulmonary tuberculosis among the employees under the dust influence. Production-related

diseases are quite diverse, and the specificity of their development depends on the specific harmful production factor.

Occupational pathology, unlike other clinical disciplines, has a pronounced social connotation, since the detection of the connection of the revealed changes in the state of health of a worker with exposure to occupational hazards entails a financial compensation for damage to his health and to be paid in full by the employer. Occupational hazards both contribute to the development of occupational diseases and affect the course of common diseases that are not related to work activity etiologically. In turn, common diseases affect the development, course and outcome of occupational ones.

The conditions and nature of labor are changing more and more every year. New factors of the production environment are acquiring new significance, the importance of high-tech industries related to the intensive development of ICT and the wide application of synthetic chemistry products is growing. As a rule, the workspace environment interacts with the human body in the course of human labor activities. At the same time, a person changes, adapts the production environment to his needs, while the production environment, forms and content of labor often have a negative impact on the psychoemotional and somatic health of workers, reducing their work capacity and labor productivity.

The diversity of the etiological factors of the production environment, the polytropic nature of their effect on certain organs and systems testify to the peculiarities of the development of occupational pathology, which is determined in turn by the peculiarity of the pathophysiological and pathomorphological reactions. The low levels of exposure of complex chemical compositions characteristic for modern industrial toxicology, mixed, combined and complex nature of their action determine the clinical and pathogenetic features of the pathomorphosis and syndromatics of modern kinds of occupational diseases and intoxications [45, 46].

The foregoing necessitates development and improvement of the criteria for early and specific diagnosis of both the initial stages of occupational diseases and the stage of body adaptation to changing

labor conditions, as well as the establishment of a system of medical monitoring and prevention, including criteria for occupational selection and occupational fitness. These issues are extremely complex, since the multiple body responses to the effects of occupational hazards, nonspecificity and pronounced individual sensitivity require the search and justification of special diagnostic criteria, both on the organ level and on the tissue level.

To assess the health status of workforce, it is advisable to consider the degree of adaptation to production conditions. Prenosological diagnostics based on the definition of adaptive potential allows to predict the development of diseases before their signs appear. The indicators characterizing the state of the cardiovascular, central and peripheral nervous system, respiratory organs, endocrine system are used as an indicator of adaptive reactions of the body. Such a methodical approach is fully justified, given that the end result of the activities of these systems is to ensure a given level of functioning of the whole organism. There is a consistent transition from satisfactory adaptation to the stress of adaptation mechanisms and then to unsatisfactory adaptation observed under stress conditions and the impact of unfavorable production factors. The transition from the regular condition to pathology, from health to illness occurs gradually as the adaptive capabilities of the organism decrease, as the stress of regulatory systems transits to their overstrain and disruption.

*Prenosological diagnostics* is a system of actions aimed at studying adaptive reserves and establishing prenosological (pre-sick) states of the human body, in connection with the impact of unfavorable factors of the production and the surrounding environment. Prenosological diagnosis has the main goal to investigate and to evaluate the state of regulatory mechanisms at the earliest stages of the process of transition from health to illness, when the body lacks pronounced functional and structural disturbances. The use of this methodological approach in occupational pathology makes it possible to take early preventive and therapeutic measures in the early stages of the emergence of occupational diseases.

To properly diagnose occupational disease, it is important to carefully study the sanitary and hygienic working conditions, the medical history of the patient, his occupational history, which includes all the types of work that he has performed from the beginning of employment. Qualitative preliminary and periodic health examinations play an important role in the timely detection of occupational diseases and the most effective treatment and prevention measures. The deep knowledge in the field of occupational and general pathology that physicians have is also important for the qualitative diagnosis of occupational diseases and especially their early forms. To this, we should add that some occupational diseases, for example, silicosis, berylliosis, asbestosis, bladder papilloma, can be detected many years after the contact with industrial hazards has been ceased.

The set of remedial measures for occupational diseases is wide enough and includes methods for treating etiological, pathogenetic and symptomatic nature. In case of acute intoxications with chemicals, the treatment should be directed to the early removal of the poison from the body, detoxification, the elimination of developing symptoms peculiar to one or another kind of intoxication. In case of intoxications accompanied by severe forms of oxygen deficiency, the oxygen therapy is indicated. In case of the treatment of metal intoxication (lead, mercury, cadmium, manganese), complexons and enterosorbents are quite effective. Among therapeutic agents, according to indications (especially severe forms with acute intoxication), cardiovascular and cardiac agents, forced diuresis, plasma alkalization, hemodialysis may be applied.

The treatment of toxic lesions of the nervous system and their long-term consequences involves a set of measures to improve cerebral and peripheral blood supply, nerve tissue metabolism, to normalize the exchange of biogenic amines, neurohumoral and neurohormonal disorders. At the same time, non-steroidal anti-inflammatory drugs, muscle relaxants, vegetotropic and psychotropic drugs, as well as vitamin therapy are applied.

The treatment of chronic occupational diseases of the respiratory organs involves the use of broad-spectrum antibiotics or

combinations thereof, bronchodilators and mucolytics, antioxidants, physiotherapy procedures whose pharmacodynamics are aimed at restoring the disturbed homeostasis. When the diseases among this group are complicated, the cardiovascular drugs, antiaggregants and oxygen therapy are widely used. For traditional therapy of allergic diseases, the antihistamine, membrane stabilizing drugs and glucocorticoids are used. Diseases of the locomotor apparatus require the use of non-steroidal anti-inflammatory drugs, vasodilators, massage and physiotherapy.

The treatment of occupational diseases involves successful application of electro- and hydrotherapy, ultrasound therapy, massage, acupuncture, as well as balneotherapeutic factors. The measures aimed at improving the general condition of the body and its resistance (balanced nutrition, diet and vitamin therapy, sanatorium treatment) play a significant role. The most important measure is the timely transition of the sick to work, which is not related to the impact of occupational hazards.

## **7.2. Incidence of Occupational Diseases, Medical Treatment Management for Industrial Employees**

Occupational diseases are one of the most important criteria for the influence of various production factors on the health state of the working population, and this raises the urgent need to have reliable information about the frequency and nature of the incidence of this group of diseases in separate age, sex, social and other groups of the population, which will ultimately help improve the effectiveness of medical and social activities, and improve the planning of the provision of specialized medical care to patients and rational use of physical and human resources of healthcare system. Reliable information about occupational morbidity and its links with various factors of the workspace environment and the labor process is becoming increasingly important for the development of measures to

prevent these diseases, as well as to preserve the work capacity in patients.

According to the Committee on Statistics of the Republic of Kazakhstan, the total nationwide population in 2008 was 15776.5 million people, while the economically active population was 53%, of which 1498.0 million people work in industrial enterprises and agricultural production. The number of employees in harmful and dangerous working conditions amounted to 678857 people, including women - 132008.

Against the backdrop of production intensification, the wear and tear of the main production facilities (equipment, machinery, vehicles, etc.) increases, which today is about 50%. Sanitary and hygienic labor conditions at many enterprises in the mining, metallurgical, processing and oil and gas industries leave much to be desired. The certification of workplaces at these enterprises showed both a high share of manual labor and increased levels of physical and chemical factors in the workplace; non-compliance of microclimatic parameters and illumination with hygienic requirements.

Over the past 8 years 3316 patients with a primary diagnosis of chronic occupational disease with professional incapacitation have been registered in the Republic of Kazakhstan. Table 63 presents the occupational morbidity in separate regions (data of the National Center for Occupational Health and Diseases, MoH and SD of Kazakhstan from 2015). It should be noted that the highest levels of occupational morbidity are observed in Karaganda and East Kazakhstan regions. At the same time, occupational morbidity is not detected or diagnosed in isolated cases in the overwhelming majority of Kazakhstan regions, although hundreds of thousands of people continue to work in harmful working conditions. There are many reasons for this, due to objective and subjective reasons.

**Table 63.** Occupational morbidity by regions of the Republic of Kazakhstan for 2012-2014 (in absolute numbers).

No.	Regions	2012	2013	2014
1	City of Astana	1	7	2
2	City of Almaty	0	0	1
3	Almaty (region)	0	2	0
4	Akmola	6	5	9
5	Aktobe	2	3	4
6	Atyrau	2	1	0
7	East Kazakhstan	187	141	146
8	Zhambyl	24	24	22
9	West Kazakhstan	2	0	0
10	South Kazakhstan	0	2	5
11	Karaganda	331	374	404
12	Kyzylorda	0	0	1
13	Kostanay	0	0	2
14	Mangystau	0	2	0
15	Pavlodar	5	3	3
16	North Kazakhstan	1	0	1
	<b>TOTAL</b>	<b>561</b>	<b>563</b>	<b>600</b>

It should be noted that the registered level of occupational morbidity in the Republic does not reflect the reality and is inadequate to the existing working conditions in certain industries. The registered level of occupational morbidity in Kazakhstan is much lower than that of European countries, and it was 4.2 per 10,000 workers in 2009. While in Finland, with the predominantly high-tech production, the incidence rate of diseases is 25. Kazakhstan is reported to have the primary (raw) industry concentrated - the most harmful and dangerous one for health.

The structure of occupational pathology in 2007-2009 has the leading places occupied by diseases from the effects of industrial aerosols (36%), physical overloads and overstrain of separate organs and systems (34%), physical factor-exposed diseases (13%), chemical factors (11.6%), exposure to industrial allergens (5%) and biological factors (0.4%). Diseases of the musculoskeletal system, connective tissue and respiratory organs are predominant in the structure of occupational pathology.

The current situation with the health care of the working population and the low level of detection of primary occupational morbidity, first of all, is due to the inadequacy of the legislation on labor safety and the lack of clear lines of regulation of the relations between the economic entity - the employer - and the employee on the one hand, and social insurance, health authorities - on the other hand.

The medical aspects of the causes of incomplete and late detection of occupational diseases are the following factors:

- the elimination of industrial (workshop) medicine, which includes medical units, aid posts, sanatoriums, dispensaries, public and dietary catering facilities, etc.;
- poor quality of ongoing examinations, due to the insufficient qualification of specialists from healthcare providers in occupational pathology and the poor condition of the physical facilities, which does not allow to carry out the necessary regulated set of surveys;

- poor quality certification of workplaces and insufficiently complete registration of sanitary and epidemiological characteristics of working conditions;
- the employer' demotivation in identifying occupational diseases in connection with the prospects for increasing insurance payments;
- deliberate concealment of common diseases by the employee, as well as concealment of early signs of occupational diseases due to fear of job loss;
- lack of proper interaction between the Health Department, the State Sanitary Epidemiological Supervision Department, the Department of the Committee for Medical and Pharmaceutical Activities Supervision in the issues of qualitative medical examinations and the improvement of the occupational pathology assistance to the working population.

The above reasons often lead to the fact that occupational diseases are masked in the structure of the overall morbidity and, as a consequence, this category of patients does not receive adequate treatment. As a result, weighting of the primary revealed pathology, polysystemic damage to the body is noted, while disability is increasing. According to the National Center for Occupational Health and Occupational Diseases under the Ministry of Health and the Republic of Kazakhstan, the share of patients with neglected cases of occupational diseases has remained high over the past three years (49% in 2012, 45.1% in 2013, 36.5% 2014). The detected occupational morbidity is characterized by a high proportion of combined cases with two or more diagnoses - up to 19.5% in 2012 (a total of 534 patients had 629 cases identified).

The Republic of Kazakhstan adopted the compulsory system of registration of occupational diseases, which is based on the decrees of the Ministry of Education and Science of the Republic of Kazakhstan No. 440 dated 23 June 2015, No. 440 "On Approval of the Rules for the Investigation of Infectious and Parasitic, Occupational Diseases and Intoxication", No. 451 dated 24 June 2015 "On Approval of the Rules for Registration, Record-Keeping of Cases of Infectious, Parasitic, Occupational Diseases and

Intoxication and Rules for Reporting Thereon". The decree of the Ministry of Health of the Republic of Kazakhstan No. 374 dated 25.05.2012 "On Approval of Regulation on the Activity of Healthcare Providers for Occupational Pathology to the People of the Republic of Kazakhstan" defines the status and powers of healthcare providers for occupational pathology, depending on the administrative-territorial affiliation; the tasks of the National Center for Occupational Health and Occupational Diseases in this area and the functions of the occupational pathology office were formulated. However, the registered level of occupational morbidity, according to the Committee on Consumer Protection, is insufficient. More effective provision of specific assistance to the workers requires information about the accumulated occupational morbidity, the number of people working in contact with specific occupational hazards, and the number of employees subject to periodic medical examinations. It is also important to have information both on the age-sex and trainee composition, as well as on individual disease entities and the degree of disability of the entire subpopulations of patients and handicapped persons with occupational diseases, their outcome and course.

The structure of medical and social care of workers in the country is currently represented by the following institutions and services:

- The National Center for Occupational Health and Diseases under the Ministry of Health and Social Development of Kazakhstan and its branches - Eastern, Western and Southern;
- Research Institute of Occupational Safety under the Ministry of Health and Social Development of the Republic of Kazakhstan;
- Departments of the Committee for Consumer Protection and regional occupational pathology offices;
- Supervision and Social Care Departments;
- Local healthcare providers of the general medical network and the remaining special network of healthcare providers sharply reduced in industrial enterprises (medical units, aid posts);
- Sanatoriums, recreation houses, afterwork disease prevention centers;

- Health and safety services for enterprises and organizations;
- Medical-labor expert commission bodies;
- Pension coverage system.

Currently, medical aid for occupational pathology to the people of the country is provided by the republic's medical institutions and the National Center for Occupational Health and Diseases under the Ministry of Health and Social Development of the Republic of Kazakhstan (Decree No. 374 of the Ministry of Health and Social Development of the Republic of Kazakhstan dated 25.05.2012). Examination of the connection between the disease and the occupation is carried out by the republican expert-professional pathological commission.

This structure of rendering occupational pathological assistance to the working population, as can be seen from the above, does not allow to solve in full all problems and issues in the field of maintaining and strengthening the health of workers. Medical aspects of maintaining the people's health engaged in production should be carried out by a multidisciplinary medical service capable both of provision of direct medical assistance in the hospital and of detection and controlling the risk of health damage in the conditions of occupational and non-occupational exposure to unfavorable factors of production and the environment. In this aspect, it is extremely important to introduce a new OSH management system - the occupational risk management system at each workplace and involve the main parties of the social partnership - employers and employees - into managing these risks. The necessity to shape this occupational risk management system presupposes the solution of a complex of organizational and legal, financial and economic, industrial and technological, medical and sanitary measures aimed at minimizing the impact of adverse industrial and environmental factors on the health of the working subpopulations.

Unfortunately, the occupational pathology service in the existing form did not fully justify the hopes placed on it. An example of this is the fact that the indicators of the detected occupational morbidity in the country are much lower than in countries with a high technological level of development and a fully functioning

production safety system. Local healthcare providers that conduct preliminary and periodic medical examinations do not adequately provide the necessary volume of preventive, therapeutic-diagnostic, rehabilitation and expert measures to the workers. Primarily detected occupational diseases, as a rule, are recorded in the late stages of development, with a sharp decline in professional and general performance and disability. There is no register of occupational diseases, which does not provide the necessary information about the nature of the clinical course of occupational diseases, the effectiveness of decisions taken on the health survey of workers and rehabilitation measures.

The ongoing reform of various sectors of the economy, including health care and the workflow arrangement system, requires both reducing costs and increasing economic efficiency, as well as the harmonization of the applicable legislation with ILO requirements and approaches, adapting it to the practice of developed countries, taking into account domestic experience. The significant changes that have taken place in the system of social protection and medical and social insurance of workers engaged in production are not integrated into the public service of medical and social expertise, which is characterized with the improvement of the system of using financial allocations of enterprises and organizations for social insurance in respect of compensation of damage to victims at work and establishment of the register of insured cases for occupational diseases.

The system of training of occupational physicians leaves much to be desired as well, who should have a more fundamental training in the specialty of "Preventive Medicine" after completing medical universities and academies. The Ministry of Education and Science of the Republic of Kazakhstan approved the specialty "Occupational Medicine (14.00.50)", with the training of relevant scientific personnel was started according to it. However, the need to obtain integrated knowledge in the field of occupational safety and international experience in solving complex interdepartmental, sectoral and private health issues of the working population is not

enough in the higher education institutions and postgraduate training of occupational physicians.

Given all of the above, it is necessary to admit that it is time to establish an improved management system for the state of health of workers employed in production. In addition, such a system is the occupational medicine, which has been widely developed in the advanced countries. The shaping of a model of the occupational medicine system in Kazakhstan should include the establishment of a republican national research center for occupational medicine, regional, urban and district centers of occupational medicine, as well as centers for occupational medicine at large and medium-sized enterprises.

We believe that the main challenge of the republican national research center of occupational medicine should be the coordination and integration of scientific, policy-making, research, organizational, economic, educational and information activities in the country on the problems of protecting the health of the working population, by providing highly specialized and specialized medical care to patients with occupational diseases, occupational safety and rehabilitation of disabled persons, as well as international activities in these areas. Moreover, according to the definition of WHO, the experts in occupational medicine are persons accredited to work in any profession related to occupational medicine or providing labor medicine services in accordance with the relevant regulations. Experts in occupational medicine include everyone who, by their profession, performs the tasks of occupational safety and occupational medicine, provides the services of occupational medicine or those engaged in the practice of occupational medicine. They can be physicians in occupational medicine, nurses, health and labor inspectors, occupational hygienists, labor psychologists and specialists dealing with ergonomics, preventing accidents and improving the workspace environment, as well as research on occupational safety and medicine.

Functions of the regional, urban and district centers of occupational medicine should be to provide organizational and methodological assistance and to perform monitoring functions on

the arrangement of medical and medico-social care for workers; to carry out periodic preventive examinations and expertise of professional suitability; to provide consultative and inpatient specialized occupational medical care and expertise of communication of the disease with the profession; to refer patients to medical and social expertise; to provide medical and rehabilitation assistance to patients and people with disabilities for occupational diseases. The functions of this network of occupational medicine centers should also include coordination of joint activities for the protection of health workers with health institutions, the State Sanitary Epidemiological Service, social protection and social insurance agencies, employers and other concerned entities and individuals. Within the framework of these structures, it is necessary to modernize the occupational pathology service with the creation of regional occupational cabinets as well, both at the level of regional healthcare providers and large industrial enterprises.

Only the establishment of such a specialized service with the arrangement of a vertical integrated system, as well as the formation of an effective legal and economic mechanism for regulating the health of the working population, taking into account the interests of the employer, employee and state, will preserve and strengthen the country's labor potential.

### **7.3. Occupational Disease Prevention**

Prevention of occupational and production-related diseases is a system of medical and social measures. Being a single integrated interdepartmental system, medical and social prevention ensures the regularity of medical examinations and dynamic monitoring of the health status of each working person provides for measures to improve environmental conditions, including production and household ones, physical and mental personal development, prevention and treatment of diseases, shaping of healthy lifestyle and increasing people's labor activity.

However, the development and advance of many occupational and production-related diseases depends on the impact of an extremely wide range of environmental, industrial and social factors, whose adverse effect on the body in turn is determined by the characteristics of their combined, complex and mixed effects. In this regard, measures for prevention thereof should include both an individual, group, population level, and the state and regional levels, and include a specific place of work as well.

Specific importance in the above system of preventive measures is given to hygienic and epidemiology measures carried out by the sanitary and epidemiological service and prevention and treatment facilities, which include environmental protection, technology improvement and labor conditions improvement, preventive sanitary supervision over the design, construction and operation of new facilities, prevention and treatment of occupational diseases; early detection and clinical examination of patients with occupational and production-related diseases, prevention of occupational injuries. In this system of measures for the dynamic monitoring of the health status of the clinics, a reliable means of monitoring of the quality of the workspace environment is the timely certification of production facilities by working conditions.

*Prevention* is a system of state, social, hygienic and medical measures aimed at ensuring high levels of health and disease prevention.

*Medical preventive care* is a complex of specific measures aimed at eliminating the causes and conditions of disease and conducted by healthcare authorities and institutions to prevent the onset of diseases, their early detection, timely treatment and rehabilitation of patients.

*Social prevention* is the branch of social policy aimed at providing the necessary conditions with a beneficial effect on the health of every person and society as a whole (the right to work and rest, pensions, social protection in case of disability and illness, etc.).

*The dispensary method* is a set of forms of work of public health authorities and institutions that arrange preventive and treatment measures in the process of active dynamic medical

supervision of healthy and sick people with the aim of increasing labor productivity, maintaining work capacity and increasing life expectancy.

The most important part of medical preventive care and dispensary are reported to be medical examinations of workers, with the preservation of the health and working capacity of the working population. Within the framework of periodic medical examinations, the tasks of dispensary observation of patients with chronic occupational and general diseases are solved, as well as referral of patients to hospitalization, identification of workers with early signs of the impact of production factors and the appointment of courses of preventive treatment, and individual medical and preventive measures. At the same time, it is very important to address the issues of occupational fitness and rational employment of patients, to analyze the findings of medical examinations with the development of a set of measures to improve working conditions and to reduce morbidity as well.

An active medical examination of different groups of the population, including industrial workers, by doctors of one or several areas of expertise, laboratory diagnostic studies for the purpose of assessing the state of health and early detection of diseases are carried out by local diagnostic and treatment outpatient departments, as well as medical units, dispensaries and aid posts directly operating at the plants and factories. The main person and the central figure in the dispensary care is the district primary care doctor, who is responsible for direct dispensary care of the population of the district and for attracting doctors of other areas of expertise to dispensary supervision.

Each worker registered on dispensary for diseases is provided with an individual health plan, which serves as the basis for further medical-preventive activities. On this basis, the doctors make applications for sanatorium treatment, medical and dietary nutrition, employment and additional leaves.

The efficiency of the health survey of the working population is determined by many simultaneously acting factors. First of all, the rationality of planning the network of treatment and prevention



facilities is important. The compliance of the medical and nursing staff with the needs of the served population, the clear arrangement of patients' admission to hospitals and clinics, the rational arrangement of doctors' work and the operation of support units, a close relationship between local and workshop district doctors have a great importance. The use of the dispensary method, which is an organizational system of medical and social prevention, requires good physical infrastructure of prevention and treatment facilities, high professional training of specialists who must know the basics of occupational health and occupational pathology and have a good preparation for examination of work capacity and on issues of employment.

The system of industrial workers' health survey distinguishes three groups of dispensary observation, which are formed given individual pathological signs or their combinations, the nature of the influencing factor and the features of the pathology caused thereby:

D<sub>1</sub> – people without any signs of exposure to factors in the workspace environment;

D<sub>2</sub> – high risk group for occupational diseases;

D<sub>3</sub> – patients with occupational diseases.

Timely detachment of risk groups of the development of occupational diseases and the implementation of health improving activities in connection therewith play a crucial role in the system of preventive measures concerning the health maintenance of the working population. The D<sub>2</sub> group should include all persons working in conditions of exposure to harmful factors of the production environment above the MPC and MPL and with a work experience exceeding 10 years. The same group should include persons with symptoms that are "critical" for the acting factor. D<sub>3</sub> Group consists of patients with occupational diseases.

Principles of health survey of patients with occupational diseases:

- After the diagnosis of occupational disease has been determined, including those with initial, clinical mild forms, all patients are taken to the dispensary register;

- Patients with occupational diseases are subject to follow-up during the whole life, regardless of whether they work or are retired by age;

- Peculiarities of health survey of patients are determined by the nature of the course of certain forms of occupational diseases;

- All patients with severe forms of occupational diseases, in order to prevent their progression and complications, should receive annual course treatment in specialized occupational hospitals;

- Rational employment, which is an obligatory component of the rehabilitation of patients, plays an important role in the system of health survey of patients with occupational diseases.

Therefore, the prevention of occupational diseases is aimed both at reducing the impact of risk factors and preventing the development of health abnormalities, as well as includes a set of medical, social, sanitary and psychological, and other measures aimed at preventing exacerbations, complications and chronic diseases, limitation of life and work capacity, reduction of general and professional capacity for work, disability and premature mortality.

#### **7.4. Medical-Labor Expert Commission and Rehabilitation Issues at Occupational Diseases**

One of the leading places in the work of public health and social protection authorities and institutions is occupied by medical-labor expert commission and rehabilitation issues at occupational diseases. The main regulatory provisions on these issues are formulated in the following regulatory documents. By the decree of the Minister of Labor and Social Protection of the Population of the Republic of Kazakhstan dated 7 November 2005 No. 287-p, the Regulations on Employee Examination for Determining the Degree of Disability and the Need for Additional Types of Assistance and Care Due to Injury or Other Damage to Health Received in the

Performance of Labor (Official) Duties were approved. The Regulations are adopted with a view to implementing the paragraph 2 of Article 24 of the Law of the Republic of Kazakhstan "On Compulsory Insurance of Employer's Civil Liability for Causing Damage to Life and Health of Employee in the Performance of Labor (Official) Duties".

The Resolution of the Government of the Republic of Kazakhstan dated 31 October 2011 No. 1241 and the Decree of the Minister of Health and Social Development of the Republic of Kazakhstan dated 31 March 2015 No. 183, the *Regulations on Examination of Temporary Incapacity, Issue of Temporary Incapacity Certificate* were approved. The incapacity certificate is issued for a period not exceeding 2 months, except for cases when a longer period of incapacity is established by law. Chronically ill persons are sent for disability examination (DE) no later than 4 months from the date of disability for the same disease within 12 months. Patients with occupational diseases with unfavorable clinical and labor prediction are sent to the DE irrespective of the periods of temporary incapacity. If the DE shows no reason to consider the patient as a handicapped person and he/she continues to be temporarily disabled, then the temporary disability certificate is subject to extension through medical consultative boards (MCB) for a period of not exceeding 2 months.

In accordance with the Regulations, the employee examination to determine the degree of disability (occupational) and to determine the need for additional types of assistance and care due to occupational disease, injury or other damage to health obtained during the performance of his labor (official) duties, is carried out through a disability examination by local subdivision of the central executive body in the field of social protection of the population. Such body, subject to the Resolution of the Government of the Republic of Kazakhstan dated 29 October 2004 No. 1132, is currently the Ministry of Labor and Social Protection of Population of the Republic of Kazakhstan. It should be noted as well that the Regulations on Disability Examination were approved by the Resolution of the Government of the Republic of Kazakhstan of 20

July 2005 No. 750. Pursuant to this Resolution, the head of the relevant healthcare provider bears responsibility for the quality of the medical examination, timeliness and validity of referring people to disability examination.

**Temporary disability** is a condition of reversible disability, that is, the body functions are restored in a relatively short period of time and the patient returns to work in the specialty. In case of *full temporary incapacity*, the patient is issued an incapacity certificate for the entire period of the disease. *Partial temporary incapacity* occurs when the patient temporarily cannot perform work in his field, but can perform other, facilitated work without health damage. **Permanent disability** is a condition of reversible health disorder and sustainable when it takes a long time for the patient to start working. Algorithm for solving expert issues relating to work capacity and employment of patients with acute and chronic forms of occupational diseases and intoxication is shown in Figure 31.

## Algorithm for Solving Expert Issues of Work Capacity and Employment of Patients with Occupational Diseases



Occupational disease	Loss of working capacity	Occupational forecast	Clinical prediction	Disability category
Acute forms of occupational diseases and intoxications of light and medium degree	Partial temporary incapacity	Temporary deprivation from contact with a harmful production factor, temporary rational employment.  After complete clinical recovery and in the absence of complications, the workers can be returned to their former work on condition of dynamic medical supervision and observance of hygienic standards	Favorable (complete recovery or significant recovery of impaired body functions in a short time)	N/A
Initial stages of chronic occupational diseases (regression is possible)	Partial temporary incapacity	Temporary deprivation from contact with a harmful production factor, temporary rational employment.  In some cases, a transfer to work outside the impact of occupational hazards is required (according to a prophylactic indication).	Favorable (complete recovery or significant recovery of impaired body functions in a short time)	N/A

Acute forms of occupational diseases and intoxications (severe and moderately expressed forms).	Complete temporary incapacity	After the earlier expressed forms of intoxications even at full restoration of the broken functions and work capacity, the further termination of work in harmful conditions at obligatory dynamic medical supervision is indicated	Favorable (complete recovery or significant recovery of impaired body functions in a short time)  Relatively favorable (incomplete restoration of impaired functions, worsening or aggravation of deliquescent current general disease, appearance of complications)	N/A  III disability category may apply
Advanced stages of occupational diseases (shaped irreversible organic changes, rapid progression, poorly treatable and prone to frequent relapses, complications of occupational diseases, immediate and long-term consequences, severe deterioration of health under the influence of the course of common diseases)	Fixed (permanent or prolonged) disability	No constant physical assistance is required. ▪ Grounds for disability categorization: the need to transit a patient to another job of lower skill due to his disease; the need for a patient's health condition to change the conditions of his work significantly, which lead to a sharp reduction in the volume of production activities and a decrease in labor productivity; significant limitation of rational employment of a patient with severe functional	Relatively favorable (incomplete restoration or partial restoration of the body functions impaired)	III

		impairment, due to low qualifications or lack of labor experience; anatomical defects or deformations that entail functional disorders, significant difficulties in performing occupational labor. No constant physical assistance is required. <ul style="list-style-type: none"> <li>▪ Grounds for disability categorization: inaccessibility of labor activity due to the presence of severe functional disorders in the patient; the possibility of health deterioration under the influence of labor activity; a disease that makes possible to work only in special conditions.</li> </ul> Incapable of work, cannot service themselves and require constant external care and supervision.	Relatively favorable (incomplete restoration or partial restoration of the body functions impaired)	II
			Unfavorable	I

**Figure No. 31**

The degree of occupational disability (OD) is determined by an employee who has received a personal injury or other damage to health while performing his labor (official) duties. If an employee has several occupations, the main occupation when establishing the OD degree should be one where the health has been damaged or with a longer labor experience and the highest qualification achieved, or the one obtained through special education. In case of loss of occupational capacity, a person who has received an occupational disease, an injury or other damage to health while performing his labor (official) duties, receives OD within the range from 5 to 100 percent.

*Degree of occupational disability* is the amount of deviation from the ability of a person to perform work of a certain qualification, volume and quality in specific labor conditions, expressed as a percentage of lost working capacity.

*Disability examination* is determination of the needs of the person to be inspected in social protection measures in accordance with the established procedure, including rehabilitation on the basis of an assessment of the life activity limitations caused by persistent disorders of body functions.

*Physical dysfunction* is a complete or partial loss of a person's capacity or ability to perform self-service, to move independently, to guide himself, to communicate, to control his behavior, to learn and to engage in work.

*General work capacity* is the ability of a person to perform any (unskilled) work, to provide services.

*Occupational capacity* is the ability of a person to perform work of a certain qualification, scope and quality in specific conditions.

*Rehabilitation of the disabled* is a set of medical, social and occupational measures aimed at elimination or, perhaps, complete compensation for life-cycle impairments caused by health disorder with a persistent body dysfunctions.

*Rehabilitation capacity* is an indicator of the actual possibilities of restoring the disturbed body functions and the abilities

of the disabled person on the basis of analysis of medical, psychological and social factors.

*Rehabilitation prediction* is the estimated implementation probability of rehabilitation capacity and the expected integration level of the disabled person into society.

According to the degree of body dysfunctions resulting in the disablement, the employees get the OD percentage as follows: if an employee can continue occupational activity with a moderate or insignificant decrease in qualifications, or with a decrease in the scope of work performed, or if the performance of his occupational activity requires more tension than before, the degree of occupational disability is set within 5 to 30 percent; if an employee can continue his occupational activity under regular production conditions with a marked decrease in his qualifications or with a reduction in the scope of work performed, or if he has lost the ability to continue his occupational activity due to a mild violation of body functions, the degree of occupational disability is set within 30 to 60 percent; if an employee, due to a pronounced impairment of the body's functions, can perform occupational activities only in specially provided conditions, the degree of occupational disability is set within 60 to 90 percent; if an employee has a complete occupational disability due to a pronounced violation of the body's functions with absolute counterindications for the performance of any type of occupational activity, even in specially provided conditions, the degree of occupational disability is set at 100 percent.

If any occupational illness, injury or other damage to health, which was obtained during the performance of labor (official) duties by an employee, worsened the course of the previously existing disease, then the OD percentage is set on the basis of the degree of expression of previously existing body dysfunctions and disability. In case of complications of occupational diseases, consequences of injury or other health damage received from the same employer, the OD degree is set in percentages within the same scopes as those corresponding to the severity of the body dysfunctions and disability in certain occupational diseases and injuries. If damage to health or

injuries are received at different enterprises, the OD degree is set separately for each case.

According to the Rules, the employees are subject to examination within the local subdivision with persistent violations of the body's functions, leading to permanent disability (occupational) due to occupational disease, injury or other damage to health obtained during the performance of their labor (official) duties after the healthcare providers have performed the necessary diagnostic and rehabilitation measures, not later than four months.

The examination to determine the degree of disability (occupational) and to determine the need for additional types of assistance and care is carried out at the place of residence of the employee when submitting the following documents: referral to disability examination (form No. 088y) no later than one month from the day of registration; the identification document; information about the place of residence; outpatient card; information on labor activity; the certificate of accident or other damage to the health of employees related to work activities on form H-1, approved by the Resolution of the Government of the Republic of Kazakhstan dated 3 March 2001 No. 326 "On Approval of the Regulations for Investigation and Recording Accidents and Other Health Damage of Employees Associated with Labor Activities"; the findings of the Republican state budget-supported enterprise "National Center for Occupational Health and Occupational Diseases" no later than two years ago (in the case of an occupational disease).

Insurance payments are assigned monthly and are paid for the entire period of occupational disability of the victim from the day when DE identified the loss of occupational capacity, except for the period of temporary incapacity. For persons with occupational diseases, compensation for damage to health is provided in the form of additional medical assistance, supplementary food and purchase of medicines; nursing (special medical and domestic) care of the employee, including those carried out by members of his family; health resort treatment, including payment of vacation for the entire period of health resort treatment and travel of the employee to the place of treatment and back, and travel of the accompanying person

to the place of sanatorium treatment and back, if required; technical auxiliary (compensatory) funds necessary for the employee at work and at home; provision with special means of transportation; vocational training (retraining).

When determining the degree of occupational disability, the severity of body dysfunctions of the injured is taken into account, leading to a restriction of the occupational capacity and other life activities. The variety of clinical signs, different in both nature and severity of impairment of functions is characteristic for occupational diseases and traumatic injuries. Polymorphism of the clinical pattern among the victims can be caused by the presence of both direct consequences of occupational diseases and injuries, and their complications. In this regard, the method of expert examination of this category of persons requires a comprehensive clinical medical study, careful study of anamnestic information, data of prevention and treatment facilities, medical, expert documentation, etc., which are necessary to substantiate the clinical and functional criteria for determining the degree of occupational disability.

As is known, the solution of expert questions in occupational diseases depends, first of all, on the clinical features of the disease, its course, and the nature of the labor conditions of the sick. At the same time, clinical and functional criteria for permanent (total) incapacity to work and disability in occupational and general diseases are the same. However, in occupational diseases, the need to transfer a patient to another job is determined by the probability of deterioration in the state of health and disease progression rather than expression of the pathology and the physical inability to perform labor duties in this profession. In this aspect, it is important, upon the appearance of the first signs of occupational disease, to take the necessary measures to improve labor conditions and rehabilitation of the sick. Moreover, the diagnosis of occupational disease does not yet determine the disability of the patient.

The evaluation of social factors - age, education, qualification, psychological pattern of the patient to continue work, etc. has a particular importance in solving expert questions. Thus, for the same degree of occupational disease, the expert findings

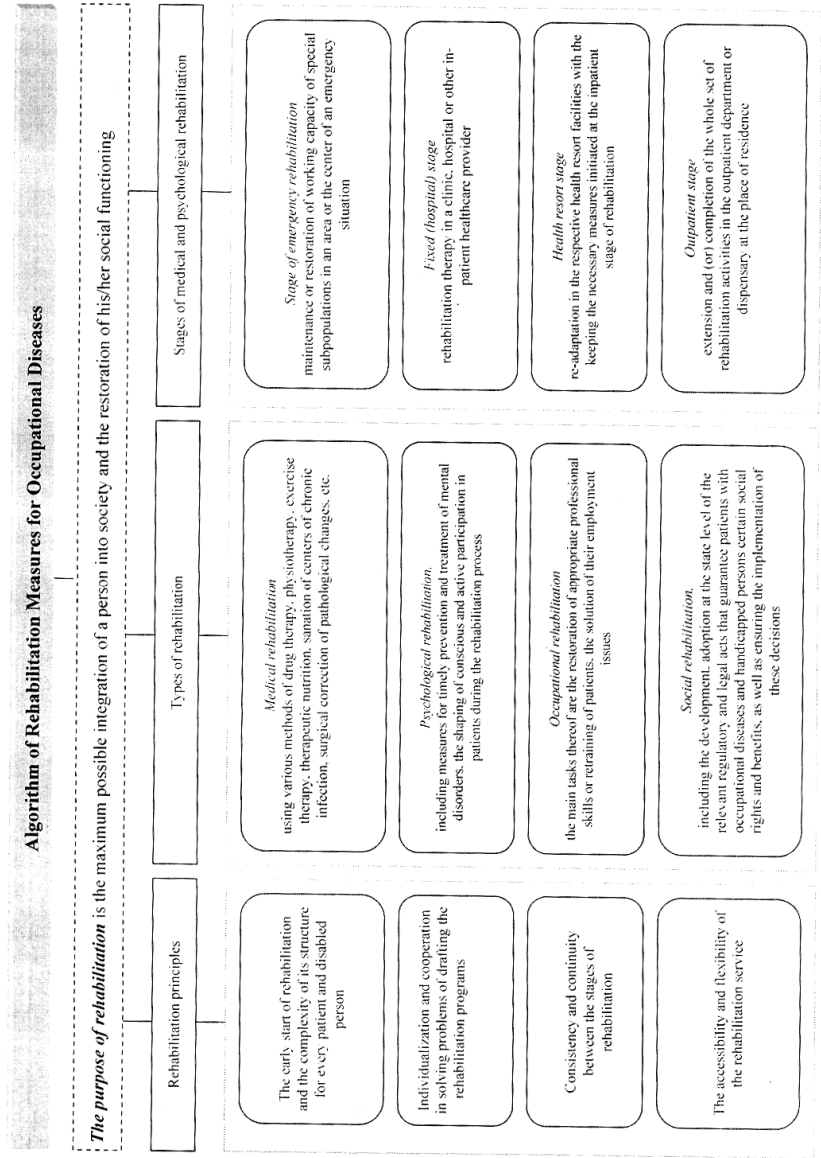
regarding persons of different age groups may be different. For young people, the decision to stop working in a harmful environment should be more categorical, they should be recommended for rational employment and (or) retraining with compensation of wages for the period of retraining. In relation to persons of older age groups, it is permissible to make compromise decisions. The workers of pre-retirement age with light forms of occupational disease and the absence of other general somatic diseases, in which counterindication of work with harmful factors, can remain in their same work for several years under dynamic medical supervision. Upon reaching the general retirement age, the patients with occupational diseases, irrespective of the severity of the disease, must stop working in contact with the harmful factors of the working environment and the labor process.

The problem of rehabilitation of patients with occupational diseases is very multifaceted. The rehabilitation process of this category of people should begin with the identification of a subpopulation of these patients subject to rehabilitation, and with the definition of its forms. The first, medical stage of rehabilitation, first of all, is required for patients with severe stages of occupational diseases. Rehabilitation measures conducted even in the early stages of occupational diseases should be aimed at restoring the body dysfunctions and prompt social adaptation. To the same extent, rehabilitation is necessary for people with severe acute forms of occupational diseases and intoxications, while the right choice of profession and rational employment are required afterwards. The whole set of rehabilitation measures is necessary for patients with occupational diseases that have received a particular disability category (see Figure 32).

Rehabilitation includes a set of coordinated treatment, psychological, social and other measures aimed at the most complete health resumption, psychological status, the ability to perform physical functions by people who have lost these opportunities. WHO defines rehabilitation as a combined and coordinated application of medical, social, training and occupational measures for

training and retraining of an individual for the optimum of his/her capacity of working.

Given the broad approach to the problem of restoring the labor and social status of the patient and the disabled, the question to be raised now concerns the allocation of recreation therapy into an independent division of medical science, since it requires the synthesis of various knowledge, opens new routes for revising a number of theoretical provisions in medicine, allows to rethink the problem of correlation of biological and social aspects in the origin, development and treatment of diseases. A doctor working in the field of recreation therapy is a rehabilitation specialist. Taking into account the specificity of each specific area of medicine, it is possible to talk about a rehabilitation trauma surgeon, rehabilitation cardiologist and, certainly, a rehabilitation occupational therapist, etc.



## Conclusion

The comprehensive medical rehabilitation of patients with occupational diseases is carried out in the system of hospital, health resort, dispensary and outpatient stages. An important condition for the successful functioning of the stage-rehabilitation system is the early onset of rehabilitation measures, the continuity of the stages, provided by the continuity of information, the unity of understanding of the pathogenetic nature of pathological processes and the bases of their pathogenetic therapy. Proceeding from the above, the proper resolution of the issues of medical and social expertise by a health worker dealing with occupational diseases requires a sufficient level of scientific and practical knowledge about the pathogenesis and clinical features of occupational diseases, their course, outcomes, complications, late effects and the degree of possible compensation for impaired functions.

The medicine has accumulated a sufficient experience in rehabilitation of patients and handicapped persons in different directions of clinical practice, including occupational pathology. A properly designed rehabilitation program based on the principles of phasing can return a large percentage of seriously ill and disabled people to active life. Such programs, supported by deep scientific knowledge in identifying the reserve and functional capabilities of the body and in determining the adequacy, harmlessness of the rehabilitation programs being developed, serve as a scientific and methodological basis for the efficiency of rehabilitation treatment. In this case, it becomes possible to determine the rehabilitation potential, which will allow both to determine the degree of work capacity correctly and, accordingly, the disability group, as well as to predict the condition of the patient or disabled person.

The issues of the modern world globalization, the economic crisis broken out as never before have sharply raised the issues of occupational safety and public health. Certainly, there is nothing more valuable and obvious than the right to life. More than a third of the conscious life is spent by each person at its workplace, contributing to the development of society. The right to the highest attainable health standards is universally recognized, which a person cannot work without, benefiting society, and achieving its own well-being.

The above principles, which determine the basic human rights, are enshrined in the fundamental documents of the International Labor Organization (ILO) and the Organization for Security and Cooperation in Europe (OSCE), chaired by Kazakhstan, which proclaimed that the key agenda of the Organization and chairmanship is the human dimension [47-49].

The labor conditions and the population's state of health in the countries of the Commonwealth of Independent States (CIS), including Kazakhstan, have been of great concern for the last two decades. The countries of this region are reported to record more than 9,000 fatal accidents annually. The anticipated life expectancy of the population, especially among men, has declined. The practice of underreporting information assumed significant proportions both regarding industrial injuries and accidents, and regarding actual information on occupational and production-related morbidity. This applies particularly to small and medium-sized enterprises, as well as to those who operate in the informal sector of economy. At the same time, there are positive trends in the region. Thus, the majority of CIS states assessed their occupational safety systems and developed programs for improvement thereof. There is a growing awareness that labor safety is a good business, and Occupational Medicine is intended to play a crucial role in preserving the health of the workers.

According to the International Labor Organization (ILO), more than 2.2 million men and women die every year worldwide as a result of accidents at work. In addition, about 337 million industrial



accidents with non-fatal outcomes are recorded. As a result of accidents and occupational diseases, four percent of the world's gross domestic product is lost, which is 20 times higher than the amount of development assistance provided by all states. In addition to the purely economic aspect of the problem, its moral aspect should be emphasized as well: one cannot reconcile with human losses associated with poor working conditions [8, 11, 49].

The main and basic direction of the state policy in the Republic of Kazakhstan in the field of occupational safety is the prioritization of life and preservation of workers' health. Annually, the pace of measures to preserve occupational health and professional longevity is increasing due to new legal acts on the provision of comfortable working conditions, the development of various technical regulations, sectoral and intersectoral standards, and the ratification of ILO Conventions [50]. At the same time, the lack of adequate intersectoral and interagency cooperation in this area does not allow improving the efficiency of organizational, technical, processing, sanitary and hygienic measures, regulations and rules aimed at preserving the life and health of workers in the course of their labor activity [51].

Joint preventive activity in the field of improving labor conditions and preserving the health of workers at industrial enterprises of executive authorities, state sanitary, environmental and technical supervision, trade unions and employers should be carried out within the framework of the Main Directions of Measures on Occupational Safety and Health Promotion of the Working Population approved annually by the Government. These efforts should be aimed at achieving the main goal - the establishment of a fundamentally new system for managing occupational safety and health, which should be based both on preventive analysis and management of occupational risks, and on improving the structure of the provision of occupational care throughout the vertical of implementation thereof. This approach involves assessing the labor conditions at each workplace jointly with an assessment of the workers' health. It is necessary to make transition from a response to cases of occupational injuries, occupational and general morbidity to

management of health risks of workers to be based on the mechanism of social partnership and initiatives of corporate social responsibility of all structures of the executive branch.

The occupational medicine as a direction of preventive medicine has developed at the intersection of labor hygiene, labor physiology, industrial ecology, toxicology, clinical disciplines, including occupational pathology, epidemiology, public health, etc. The purpose of occupational medicine is to manage the employed human health state, while the subject is the scientific rationale and the practical introduction of means and methods for its preservation and strengthening. International programs and WHO institutes in the field of occupational medicine (UNEP, GEENET, IPCS, IOMC, OECD, IARC, ICON, NDPHS, BSN, CIS, UNCTAD, HESME) create the foundation for management of health, environment, safety and social capacity in enterprises, allowing to control the health both of workers and of their families, taking into account the environment, lifestyle, industrial and social health factors, as well as the quality of healthcare system.

A considerable amount of knowledge has been accumulated in the international labor standards, codes of practice and recommendations developed by the International Labor Organization over the past 90 years, which formulate fundamental principles and rights in the field of occupational safety. They are jointly a kind of international labor code that establishes minimum standards for the protection of workers' rights in this field. The established set of international production regulations is an authoritative guide for the national authorities, employers, workers and their entities in matters of occupational safety and the workers' health maintenance.

Integration of the Republic of Kazakhstan into the world labor market, entry into a single customs and economic union with Russia and Belarus, the establishment of the Eurasian Economic Union and accession to the WTO predetermined the need for its accession to relevant international companies and ratification of relevant documents on occupational health and safety of the working population.

By virtue of the Constitution and the Labor Code of the Republic of Kazakhstan, international legal acts in the field of security, occupational safety and the working population health maintenance, the main task of occupational medicine in the Republic of Kazakhstan should be the coordination and integration of research, scientific, organizational and economic activities, as well as improvement of educational and information activities on the issues of maintaining and promoting the health of the working population, rehabilitation of the disabled, as well as improvement of the legislative sphere in this direction.

## Appendix No. 1

### On approval of the Rules of conduction of compulsory medical examinations

Decree of the Acting Minister of Economy of the Republic of Kazakhstan No. 128 dated February 24, 2015.  
It is registered at the Ministry of Justice of the Republic of Kazakhstan No. 10634 dated April 8, 2015

In accordance with item 4 of article 155 of the Code of the Republic of Kazakhstan on “The People’s Health and Healthcare System” dated September 18, 2009 **it is hereby ORDERED:**

1. To approve the attached Rules of conduction of compulsory medical examinations.
2. The Committee on Consumer Protection of the Ministry of National Economy of the Republic of Kazakhstan is to ensure, as established by legislation:
  - 1) state registration of this order at the Ministry of Justice of the Republic of Kazakhstan;
  - 2) sending its copies to printed periodicals and Adilet Information and Legal System for official publication within ten calendar days upon state registration of this Decree;
  - 3) posting of this order on official Internet resource of the Ministry of National Economy of the Republic of Kazakhstan.
3. The supervising Vice-Minister of the National Economy of the Republic of Kazakhstan shall be charged with monitoring the execution of this Decree.
4. This Decree shall be brought into force in ten calendar days upon its first official publication date.

*Acting Minister of National Economy  
of the Republic of Kazakhstan  
“AGREED” by the Minister of Health  
and Social Development of  
of the Republic of Kazakhstan  
T. Dyuisenov  
March 5, 2015*

*M. Kussainov*

Approved by  
the Order of the acting Minister of  
the National Economy of  
the Republic of Kazakhstan  
dated February 24, 2015 No. 128

### **Rules of compulsory medical examination conduction**

#### 1. General provisions

1. These Rules of compulsory medical examination conduction (hereinafter referred to as the “Rules”) are developed in accordance with clause 4, Article 155 of the Code of the Republic of Kazakhstan dated September 18, 2009 “On People’s Health and the Healthcare System” (hereinafter - the Code), and determine the order and frequency of compulsory medical examinations. Execution of these Rules is mandatory for legal entities and individuals, as well as for healthcare entities, regardless of departmental affiliation and forms of ownership.

2. The following basic definitions are used in these Rules:

1) preliminary medical examinations are compulsory medical examinations that are conducted at the commencement of the employment or study in order to determine if he/she is able to fulfill professional duties or duties to study, as well as to prevent common and occupational diseases;

2) periodic medical examinations are compulsory medical examinations that are conducted to ensure dynamic monitoring of the health status, timely establishment of incipient characters of diseases, prevention and non-distribution of common, occupational, infectious and parasitic diseases;

3) decreed group of the population - people working in the service sector who are of serious hazard as they may communicate infectious and parasitic diseases to the people around them;

4) individual medical record is a personal document issued to a representative of a decreed group of the population, in which the results of compulsory medical examinations with a mark of permit to work are recorded.

1. The procedure for conducting compulsory (preliminary and periodic) medical examinations of those who are in contact with harmful and (or) dangerous substances and production factors

2. Compulsory medical examinations (preliminary and periodic) are conducted by medical organizations that have qualified specialists and material and technical resources to carry out the full scope of laboratory and functional tests.

3. Compulsory medical examinations of aviation personnel (persons entering and studying in aviation training centers for the training of pilots, air traffic controllers serving air traffic, pilots, flight engineers (flight mechanics), navigators, flight dispatchers, flight attendants, flight operators, amateur pilots (aircraft or helicopter ), ultra-light aviation pilots, flight radio operators) are conducted in accordance with the Rules of Medical Examination in Civil Aviation of the Republic of Kazakhstan, approved by the joint order of the Minister of Transport and Communications of the Republic of Kazakhstan dated August 28, 2013 № 666 and Acting Minister of Healthcare of the Republic of Kazakhstan dated September 17, 2013 No. 532 (registered in the register of state registration of regulatory legal acts of the Republic of Kazakhstan No. 8784), subject to the compliance with the requirements of clause 10, subparagraph 4) of clause 13 and clause 14 of these Rules.

Paragraph 1. The Procedure of compulsory preliminary medical examinations of persons working in contact with harmful and (or) hazardous substances and production factors

5. Health workers of health organizations participating in conduction of compulsory preliminary medical examinations examine the employee and refer the examinee to laboratory tests.

6. The data of compulsory preliminary medical examination shall be entered in the ambulatory medical record according to the form 025/y, approved by the order of the acting Minister of Healthcare of the Republic of Kazakhstan dated November 23, 2010 No. 907 “On the approval of forms of original medical records of health organizations” (registered in the register of state registration of regulatory legal acts of the Republic of Kazakhstan No. 6697) (hereinafter - Order No. 907), with provision of an opinion on fitness of the employee to the work performed (work experience internship).

7. Persons who have passed compulsory preliminary medical examination and who are recognized to be fit to work with harmful production factors are given a medical certificate in the form 086/y, approved by Order No. 907.

8. The responsible health worker appointed by the order of the Head of healthcare organization shall issue an opinion on fitness of the employee to the requirements of the work, including requirements stipulated by the work experience internship during the period of study of students in educational institutions.

Paragraph 2. The Procedure of compulsory periodic medical examinations of persons working in contact with harmful and (or) hazardous substances and production factors

9. Compulsory periodic medical examinations shall be carried out once a year.

10. Local subdivision of the state body administration in the sphere of sanitary and epidemiological welfare of population (including in transport) shall:

- 1) monitor the completeness, quality and timeliness of compulsory medical examinations;
- 2) participate in the compilation of the results of compulsory medical examinations of employees;
- 3) upon the request of the head of the health organization servicing the organization where the patient works (worked), the head of the occupational pathology center, physical and legal persons that employed the patient, present sanitary and epidemiological characteristics of the working conditions.

11. In the case of diagnosis of infectious or parasitic disease, discovery of carrier state that is contraindication to the work performed, the responsible health worker of the healthcare organization shall send an expedited report to the local subdivision of the state body administration in the sphere of sanitary and epidemiological welfare of population and refer the patient for treatment to the relevant treatment-and-prophylactic organization at the place of residence.

12. The local subdivision of the state body administration in the sphere of sanitary and epidemiological welfare of population (including in transport) shall suspend the person from work if the person fails to pass compulsory medical examination.

13. Healthcare organization shall:

- 1) after receipt of list of groups subject to compulsory medical examinations, approved by local subdivision of the state body administration in the sphere of sanitary and epidemiological welfare of population, create the commission for conduction of compulsory periodic medical examinations and draw a calendar plan in which it determines the type and volume of laboratory and other tests taking into account the specifics of the current harmful production factors, the time and terms of the work of the medical commission. In the case of lack and deficiency of health workers conducting compulsory periodic medical examinations, the required tests are conducted in other healthcare organizations licensed for this type of activity. The plan shall be coordinated with the administration of the organization (employer);

- 2) approve the composition of the medical commission. The composition of medical commission includes health workers: a therapist, a surgeon, a

neurologist, an otolaryngologist, an ophthalmologist, a dermatovenerologist, a gynecologist, a radiologist, a functional diagnostics physician, doctor-laboratory assistant trained in occupational pathology. The chairman of the commission shall be an occupational physician who passed occupational retraining in occupational pathology and has a specialist certificate (occupational pathologist) and is responsible for the quality of compulsory periodic medical examinations. If necessary, other specialists (dentist, cardiologist, allergist, endocrinologist, phthisiologist, and hematologist) that have completed training in occupational pathology as part of their specialty shall be involved in the work of medical commission. Health workers participating in compulsory periodic medical examinations shall be acquainted with the characteristics of professional activity and working conditions of employees, represented by the employer;

- 3) provide the local subdivision of the state body administration in the sphere of sanitary and epidemiological welfare of population (including in transport), with a quarterly summary report on conducted periodic medical examination in accordance with the Annex 1 to these Rules;

- 4) summarize the results at the end of the compulsory periodic medical examinations of employees engaged in heavy work, in harmful (especially harmful) and (or) dangerous working conditions and draw a final act in 5 copies in accordance with Annex 2 to these Rules, provide it to the local subdivision of the state body administration in the sphere of sanitary and epidemiological welfare of population (including in transport), within 30 calendar days after compulsory periodic examination.

Give the name list of persons who received recommendation to change the job and for whom inpatient treatment and sanatorium-health-resort treatment, diet food, case follow up are indicated in the annexes to the act. After signing of the final acts, they should be submitted to the administration for execution, trade committee of the organization, local subdivision of the state body administration in the sphere of sanitary and epidemiological welfare of population (including in transport) for control, and territorial healthcare organizations at the employer's location for work, one copy shall be kept at medical organization that conducted the compulsory periodic medical examination;

- 5) enter the data of compulsory periodic medical examination into the ambulatory medical record in form 025/y, approved by Order No. 907 and on medical checkup insert according to the form of Annex No. 3 to these Rules which is attached to the ambulatory medical record. At the same time, every health worker participating in the compulsory periodic medical examination shall give his opinion on professional suitability. The

occupational history data shall be specified in the insert of ambulatory medical record. In the case of dismissal or transfer to another organization, ambulatory medical record with data of compulsory medical examinations shall be handed over to the healthcare organization at the new job address. Compulsory periodic medical examinations shall be conducted with the availability of the ambulatory medical record at the place of residence or extracts for ambulatory medical record;

6) issues a medical certificate according to the form 086/y, approved by Order No. 90 to the persons who passed compulsory periodic, preliminary medical examination and recognized as fit for work with harmful production factors. The expert opinion of the medical commission on professional suitability shall be made taking into account medical documentation from the place of residence regardless of the type of medical examination. At the same time, the medical commission's opinion shall not be issued to persons who don't fit for work in harmful and (or) dangerous working conditions, such opinion shall be submitted to the employer within three business days, with the notification of a person who is recognized to be unfit for work with harmful production factors.

14. The Employer shall:

1) no later than December 1 draw a name list of persons with indication of their place of work, the severity of the work performed, harmful (special harmful) and (or) dangerous working conditions, as well as the length of service in these conditions of work, with subsequent coordination with the local subdivision of the state body administration in the sphere of sanitary and epidemiological welfare of population (including in transport);

2) at its own expense, organize periodic medical examination;

3) together with the health organization servicing the enterprise or with regional health organization at the place of employer, provide the timely referral of the patients for in-depth examination and treatment to the centers of occupational pathology of persons with occupational diseases and suspected of having occupational disease;

4) together with health organization servicing the enterprise or with regional health organization at the place of employer, develop an annual plan of measures for rehabilitation of the identified patients, coordinated with local subdivision of the state body administration in the sphere of sanitary and epidemiological welfare of population (including in transport) to improve working conditions.

15. Based on the results of compulsory periodic medical examination conducted by a health organization servicing the enterprise or together with a health organization at the place of employer, groups are formed, with the

subsequent determination of the worker's belonging to one of the dispensary groups and preparation of recommendations for prevention of occupational diseases and socially significant diseases - for follow-up observations, treatment and rehabilitation:

1) healthy workers who do not need rehabilitation;

2) apparently healthy workers who have unstable functional changes in various organs and systems;

3) workers who have initial phases of common diseases;

4) workers who have apparent forms of common diseases, being or not being a contraindication for continuing work in the profession;

5) workers who have signs of harmful effects of production factors on the body;

6) workers with signs of occupational diseases.

16. In the case of absence of health organization servicing the enterprise, health organization at the place of the employer shall provide the health organizations at the place of residence with lists of persons of the formed groups of dispensary observation for further dispensary observation.

Based on the results of compulsory periodic medical examinations, the following persons are subject to dispensary observation in a health organization servicing an enterprise or a health organization at the place of residence of an employee: apparently healthy workers who have unstable functional changes in various organs and systems; workers who have initial phases of common diseases; workers who have apparent forms of common disease, being and not being a contraindication for continuing work in the profession; and persons with occupational diseases.

17. Workers who have severe forms of common diseases, both being and not being contraindicated to continue working in the profession, shall be referred to treatment and rehabilitation health organizations for rehabilitation, thereafter the workers are subject to assessment of professional suitability. Workers who after medical rehabilitation are recognized to be fit for professional work, shall be subject to dispensary observation in a group of people with the initial phases of common diseases.

18. Workers who show signs of harmful effects of production factors on the body and signs of occupational diseases shall be referred to a health organization that carries out activities to establish links between the disease and the profession.

19. Workers with occupational diseases shall be registered in dispensary records with the occupational therapist of a health organization servicing an industrial enterprise or at the place of residence.

20. The prophylactic medical examination of employees based on the results of compulsory periodic medical examinations shall be carried out on the basis of the principles of stage rehabilitation which consists of three main stages:

1) the first stage: measures to prevent diseases in apparently healthy workers at health posts at industrial enterprises, in afterwork disease prevention center;

2) the second stage: medical rehabilitation of people from the "risk group": workers who often suffer from a long-lasting catarrhal diseases, persons with various functional disorders, initial phases of common diseases, pre-clinical signs of occupational diseases through organization of dispensary observation and regular preventive treatment in outpatient and inpatient conditions with mandatory inclusion of sanatorium-health-resort rehabilitation;

3) the third stage: rehabilitation of patients with occupational diseases, including persons with disabilities as a result of these diseases at health organization that carries out activities to establish links between the disease and the profession, sanatoriums and health resorts that are licensed for this type of activity.

21. Control over dispensary observation and medical rehabilitation of patients, workers at enterprises shall be carried out by regional (city) occupational pathology cabinets with the involvement of regional health organizations and health organizations servicing the enterprises.

22. In determining the suitability for performing professional duties, healthcare authorized body shall determine general and particular medical contraindications.

3. The procedure of compulsory medical examinations of decreed groups

23. Compulsory medical examinations, laboratory tests shall be carried out by health organizations that have a state license for this type of medical activity.

24. The work permit shall be issued by an organization that has a license for medical activity - an assessment of professional suitability.

25. A person responsible (primary care doctor) for carrying out compulsory medical examinations, work permit shall be appointed by the order of the head of the organization performing compulsory medical examinations.

26. The results of compulsory medical examinations and laboratory tests shall be recorded in an individual medical record. The procedure for issuing the individual medical record, its recording and maintaining shall be determined by state body administration in the sphere of sanitary and

epidemiological welfare of population in accordance with paragraph 10, Article 155 of the Code.

27. In the case of diagnosing an infectious or parasitic disease, as well as identifying carrier state that is contraindicated to permit to the performed (elected) work, the person responsible for work permit shall refer the patient to the relevant treatment-and-prophylactic organization at the place of residence for treatment.

28. The decreed persons are admitted to work after receiving a mark of work permit in an individual medical record.

29. Individual medical records of employees shall be kept at the workplace.

30. The responsible person and laboratory specialists shall ensure the reliability and quality of medical examination, laboratory tests; also they shall ensure the sending of the expedited report to the local subdivision of the state body administration in the sphere of sanitary and epidemiological welfare of population in the case of diagnosing infectious, parasitic diseases and carrier state.

31. In the case of presence of epidemiological indications in a specific administrative territory, the list of occupations and population groups, as well as the scope and frequency of compulsory medical examinations shall be supplemented by the decision of the Chief State Health Doctor of the corresponding territory.

32. The list of workers who are subject to compulsory medical examinations, as well as the frequency and scope of laboratory and functional tests of persons working at epidemiological significant facilities is determined in Annex 4 to these Rules.

33. Compulsory medical examinations include:

1) Examination by doctors: by the therapist, dermatovenerologist, gynecologist;

2) laboratory tests: tuberculosis test (fluorographic examination of the chest - opinion of a doctor- radiotherapist); bacteriological examination for carrier state; examination for the presence of helminths; test for syphilis, gonorrhea; throat swab and nasal swab for pathogenic staphylococcus carrier state.

Appendix 1  
to the Rules of compulsory  
medical examination conduction  
Form

**Report  
of the healthcare entity on the conducted periodical  
medical examination for Quarter \_\_\_\_\_, 20 \_\_**

No.	Name	Subject to be examined		Examined		Detected with suspected occupational disease	
		Total	Women	Total	Women	Total	Women
1							
2							

Detected with physical illnesses		Including first time detected		It is necessary		Referred to in-patient examination and treatment
Total	Women	Total	Women	to temporary transfer	to constant transfer	

Head of the healthcare entity \_\_\_\_\_  
Full name (in any), Signature

Appendix 2  
to the Rules of compulsory  
medical examination conduction  
Form

**FINAL ACT  
dated \_\_\_\_\_ 20 \_\_**

According to the results of the conducted periodic medical examination (assessment) of employees

\_\_\_\_\_  
(name of organization (entity), shop)  
for the year of 20\_\_ the final act is executed with  
participation of:

Chairman of health  
authority \_\_\_\_\_  
(full name (in any),  
title)

Specialist of the local subdivision of the state body administration  
in the sphere of sanitary and epidemiological welfare of population

\_\_\_\_\_  
(full name (in any), title)  
Employer's Representative

\_\_\_\_\_  
(full name (in any), title) Representative  
of the staff

1. Number of employees of the organization (entity), shop:

total,	
including women	

2. Number of employees of the organization (entity), shop, working with harmful and(or) hazardous substances and production factors as well as at works\*:

total,	
including women	

3. Number of employees subject to periodic medical examination (assessment) working in contact with harmful and(or) hazardous substances and production factors as well as at works this year:

total,	
including women	

4. Number of employees who passed periodic medical examination (assessment):

total,	
including women	

5. % of cover with periodic medical examinations:

total,	
including women	

6. Number of employees who failed to finish/pass the periodic medical examination (assessment):

total,	
including women	

Name list of employees who failed to finish a periodic medical examination (assessment):

No.	Full name (in any)	Entity subdivision
1		
2		

7. Number of employees who failed to pass a periodic medical examination (assessment):

total,	
including women	
including the reasons out of a total number:	
sick leave certificate	
business trip	
annual leave	
dismissal	
refuse from passing	

Name list of employees who failed to pass a periodic medical examination (assessment):

No.	Full name (in any)	Entity subdivision	Reason
1			
2			

8. Conclusion according to the results of this periodic medical examination (assessment)



Summary table 1

Results of periodic medical examination (assessment)	Total	including women
1	2	3
Number of persons who are qualified to work with harmful and(or) hazardous substances and production factors, types of work*		
Number of persons who are temporary not qualified to work with harmful and(or) hazardous substances and production factors, types of work*		
Number of persons who are constantly not qualified to work with harmful and(or) hazardous substances and production factors, types of work*		
Number of persons who need to pass a follow-up examination (conclusion is not given)		
Number of persons suspected of occupational disease		
Number of persons who need to pass a follow-up examination at the center of occupational pathology		
Number of persons who need an outpatient examination and treatment		
Number of persons who need an inpatient examination and treatment:		
Number of persons who need a health resort treatment		
Number of persons who need healthful and dietary meals		
Number of persons who need a dispensary observation		

Summary table 2

No.	Full name (in any)	sex	year of birth	Sector	Occupation	Harmful and(or) hazardous substances and production factors, to types of work_*	Work experience with harmful and(or) hazardous substances and production factors, types of work	Category of disease as per MKB-10, dispensary group
1								
2								

Continuation of table:

Disease first time detected	Qualified to work_*	Temporary not qualified to work_*	Constantly not qualified to works	Conclusion is not made	Needs examination at the center of occupational pathology

Detected with physical illnesses		Including first time detected		It is necessary		Referred to in-patient examination and treatment
Total	Women	Total	Women	to temporary transfer	to constant transfer	

Head of the healthcare entity \_\_\_\_\_

Full name (in any), Signature

Continuation of table:

An outpatient examination and treatment is needed	An inpatient examination and treatment is needed	Health resort treatment is needed	Healthful and dietary meals is needed	A dispensary observation is needed

9. Persons detected with suspected occupational disease:

S/N	Full name (in any)	Entity subdivision	Occupation, title	Harmful and(or) hazardous substances and production factors
1				
2				

10. Chronic physical illnesses detected for the first time in life:

No.	Category of disease as per MKБ-10	Number of employees (total)
1		
2		

11. Chronic occupational diseases detected for the first time in life:

No.	Category of disease as per MKБ-10	Number of employees (total)
1		
2		

12. Results of recommendations fulfillment of the previous final act dated \_\_\_\_\_ 20\_\_ according to the results of the conducted periodic medical examination (assessment) of employees.

	Arrangements	Subject to (person)	Fulfilled	
			Abs.	In %
1	Examination at the center of occupational pathology			
2	Follow-up examination			
3	Treatment and outpatient examination			
4	Treatment and in-patient examination			
5	Health resort treatment			
6	Dietary meals			
7	Admitted for dispensary observation			

13. Recommendations to the employer: sanitary and healthy arrangements and so on:

\_\_\_\_\_

\_\_\_\_\_

Notes:

\* Harmful and(or) hazardous production factors according to the list of harmful factors and list of works.

\*\* To list the items of harmful and(or) hazardous factors and works according to the list of harmful factors and list of works.

Signatures:

Physician (occupational therapist, therapist)

\_\_\_\_\_

Specialist of the state authority in the sphere of sanitary and epidemiological welfare of the population

\_\_\_\_\_

Employer's representative

\_\_\_\_\_  
Organization's trade union committee representative

\_\_\_\_\_  
Head of the Health organization

\_\_\_\_\_  
Place of seal \_\_\_\_\_ full name (in any), title \_\_\_\_\_ Signature  
Head of the state authority in the sphere of sanitary and  
epidemiological welfare of the population

\_\_\_\_\_  
Place of seal \_\_\_\_\_ full name (in any), title \_\_\_\_\_ Signature  
Head of the organization (employer)

\_\_\_\_\_  
Place of seal \_\_\_\_\_ full name (in any), title \_\_\_\_\_ Signature  
Organization's trade union committee Chairman

\_\_\_\_\_  
Place of seal \_\_\_\_\_ full name (in any), title \_\_\_\_\_ Signature

**Medical examinations loose leaf**  
No. \_\_\_\_\_

1. Date of medical examination

\_\_\_\_\_  
2. Name of  
arrangement: \_\_\_\_\_

\_\_\_\_\_  
3. Name of structural subdivision (shop, sector, department, division  
and etc.) \_\_\_\_\_

\_\_\_\_\_  
4. Full name (if any) of the employee, date and year of birth, place of  
residence, occupation or title at present time

\_\_\_\_\_  
5. Total work experience

(specify the  
number of years)

6. Work experience in occupation

(specify the number of  
years)

7. Work conditions ant present time

Name of harmful and hazardous production factor	Work experience with factor (according to oral information provided)

8. Total occupational route

Month and year	Work duration	Entity	Occupation

of start and end of work			

Appendix 4  
to the Rules of compulsory  
medical examination conduction

9. Results of the preliminary (periodic) medical examination (assessment):

S/N	Examinations (specialists)	Date of fulfillment	Conclusion according to the examination results (able, not able, conclusion is not given)

S/N	Trial (tests)	Date of fulfillment	Conclusion according to the examination results (able, not able, conclusion is not given)

10. Conclusion of working ability: during the preliminary examination: able, not able (underline as appropriate) during periodic medical examination: able to work in his occupation, temporary transfer to another work for the period of months constant transfer to another work (underline as appropriate)

11. Recommendations:

Examination and treatment at outpatient clinic; Examination and treatment at in-patient clinic; to refer to a medical organization delivering a tertiary health care; referral to health resort treatment (underline as appropriate)

LS

Date of issue

\_\_\_\_\_  
Signature of the Commission Chairman

**List of employees subject to medical examination  
as well as the frequency and amount of laboratory  
and functional trial of person who work at  
epidemiologically significant facilities**

S/ N	List of works performed	Preliminary medical examinations (at entry)	Periodic medical examinations	
		Medical examination, laboratory and functional trials	Examination frequency	Laboratory and functional trials
1	2	3	4	5
1	Employees of public catering facilities and food industry	Fluorography	In every 12 months	Fluorography, test on helminth eggs, syphilis, carrier state: dysentery, salmonellosis, typhoid fever, A&B paratyphoid fever, pathogenic staphylococcus
		Test on helminth eggs, syphilis, carrier state: dysentery, salmonellosis, typhoid fever, A&B paratyphoid fever, pathogenic staphylococcus	In every 6 months	
2	Employees of food retail facilities, persons who deal with food products transportation	Fluorography, test on helminth eggs, syphilis, carrier state: dysentery, salmonellosis, typhoid fever,	In every 12 months	Fluorography, test on helminth eggs, syphilis, carrier state: dysentery, salmonellosis, typhoid fever,

		A&B paratyphoid fever, pathogenic staphylococcus		A&B paratyphoid fever, pathogenic staphylococcus
3	Employees of creamy- candy manufacture and infant-feeding centers	Fluorography	In every 12 months	Fluorography, test on helminth eggs, syphilis, carrier state: dysentery, salmonellosis, typhoid fever, A&B paratyphoid fever, pathogenic staphylococcus
		Test on helminth eggs, syphilis, carrier state: dysentery, salmonellosis, typhoid fever, A&B paratyphoid fever, pathogenic staphylococcus	In every 6 months	
4	Employees of organizations on passenger services (railway stations, air terminal, airports, sea and river ports, and subways)	Fluorography	In every 12 months	Fluorography.
5	Passenger car attendants, stewards of river transport, sea- and aircraft transport	Fluorography, test on helminth eggs, syphilis, carrier state: dysentery, salmonellosis, typhoid fever, A&B paratyphoid fever	In every 12 months	Fluorography, test on helminth eggs, syphilis, carrier state: dysentery, salmonellosis, typhoid fever, A&B paratyphoid fever
6	Employees of educational establishment of elementary, secondary, general secondary, occupational, higher education, out-school facilities, computer	Fluorography	In every 12 months (before the beginning of an academic year – June, July, August)	Fluorography

	clubs.			
7	Employees of seasonal healthy organizations for children and teenagers	Fluorography, test on helminth eggs, syphilis, carrier state: dysentery, salmonellosis, typhoid fever, A&B paratyphoid fever	In every 12 months (before the beginning of a season)	Fluorography, test on helminth eggs, syphilis, carrier state: dysentery, salmonellosis, typhoid fever, A&B paratyphoid fever
8	Employees of pre-primary organizations, boarding schools, year-around sanatory healthy organizations for children, orphanages, employees of family-type houses	Fluorography, test on helminth eggs, syphilis, carrier state: dysentery, salmonellosis, typhoid fever, A&B paratyphoid fever, pathogenic staphylococcus carrier	In every 12 months	Fluorography, test on helminth eggs, syphilis, carrier state: dysentery, salmonellosis, typhoid fever, A&B paratyphoid fever, pathogenic staphylococcus carrier
9	Health workers of maternity hospitals (departments), child health centers (departments), neonatal pathology units, prematurely-born department, as well as in-patient mixed departments of rural hospitals and day patient departments. Health workers of organizations regardless of the forms of ownership	Fluorography	In every 12 months	Fluorography, test on helminth eggs, syphilis, carrier state: dysentery, salmonellosis, typhoid fever, A&B paratyphoid fever, pathogenic staphylococcus
		Test on helminth eggs, syphilis, carrier state: dysentery, salmonellosis, typhoid fever, A&B paratyphoid fever, pathogenic staphylococcus	In every 6 months B (in every 12 months – junior medical staff)	
10	Health workers of organizations of	Fluorography, test on HIV 1,2	In every 12 months	Fluorography, test on B Hepatitis and

	blood banking, health workers of surgery, gynecologist, obstetric, hematologic, stomatologic specialization and health workers making invasive methods of diagnostic and treatment; health workers performing haemodialysis, as well as health workers of virological, bacteriological, clinical, immunologic and parasitologic laboratories	Test on B Hepatitis and C Hepatitis Viral Marker	In every 6 months (in every 12 months – junior medical staff)	C Hepatitis Viral Marker
11	Employees of health centers, recreation centers, pensionates, care homes and houses for disabled persons and old people, medical and social workers at home	Fluorography, test on helminth eggs, carrier state: dysentery, salmonellosis, typhoid fever, A&B paratyphoid fever	In every 12 months	Fluorography, test on helminth eggs, carrier state: dysentery, salmonellosis, typhoid fever, A&B paratyphoid fever
12	Service workers (bath-houses, wash-rooms, saunas, hairdressing salons, skin care shops, laundry, dry-cleaning), employees of swimming-pools and hydropathical	Fluorography, test on helminth eggs, syphilis, Employees of facilities fulfilling operations with solution of continuity of skin cover shall be	In every 12 months	Fluorography, test on helminth eggs, syphilis, tests on B&C hepatitis viral markers

	establishments, mud baths, sports and health organizations, managers, administrators, supervisors of floors at hotels, motels, dormitories, and camping areas	examined on B&C hepatitis viral markers		
13	Employees of chemists shops, pharmaceutical organizations (plants, factories), engaged in manufacture, packaging and sale of pharmaceutical products	Fluorography	In every 12 months	Fluorography
14	Employees of water works with direct relation to water preparation, persons servicing water supply networks, employees of production laboratories, water supply and sewage facilities	Fluorography, test on helminth eggs, syphilis, carrier state: dysentery, salmonellosis, typhoid fever, A&B paratyphoid fever	In every 12 months	Fluorography, test on helminth eggs, syphilis, carrier state: dysentery, salmonellosis, typhoid fever, A&B paratyphoid fever
15	Students of general academic schools, specialized secondary and higher establishments before the beginning and	Fluorography. Laboratory and functional trials shall be conducted in accordance with the organization	During the traineeship once in 12 months, fluorography	Fluorography. Laboratory and functional trials shall be conducted in accordance with the organization

	during the traineeship in organizations as employees subject to compulsory medical examinations	category where the practice will be done		category where the practice will be done
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**On approval of the Rules for investigation of cases of infectious and parasitic, occupational diseases and intoxication of population**

Decree of the Minister of National Economy of the Republic of Kazakhstan No. 440 dated June 23, 2015. It is registered at the Ministry of Justice of the Republic of Kazakhstan under No. 11748 dated July 24, 2015.

In accordance with item 2 of article 151 of the Code of the Republic of Kazakhstan dated September 18, 2009 “On People’s Health and Healthcare System”, **it is hereby ORDERED:**

1. To approve the attached Rules for investigation of cases of infectious and parasitic, occupational diseases and intoxication of population.
2. The Committee on Consumer Protection of the Ministry of National Economy of the Republic of Kazakhstan is to ensure, as established by legislation:
  - 1) state registration of this order at the Ministry of Justice of the Republic of Kazakhstan;
  - 2) sending its copies to printed periodicals and Adilet Information and Legal System for official publication within ten calendar days upon state registration hereof at the Ministry of Justice of the Republic of Kazakhstan;
  - 3) posting of this order on official Internet resource of the Ministry of National Economy of the Republic of Kazakhstan.
3. To declare the decree of the Minister of Health of the Republic of Kazakhstan of November 12, 2009, No. 705 “On establishing the Rules for investigation of cases of infectious and parasitic, occupational diseases and intoxication of population” (recorded in the State Register of regulatory legal acts No. 5907 and published in the Corpus of acts of central executive agencies and other central governmental authorities of the Republic of Kazakhstan No. 2, 2010) to be no longer in force.
4. The supervising Vice-Minister of the National Economy of the Republic of Kazakhstan shall be charged with monitoring the execution of this Decree.

5. This Decree shall be brought into force in ten calendar days upon its first official publication date.

*Minister of National Economy  
of the Republic of Kazakhstan  
“AGREED by”  
the Minister of Health  
and Social Development of  
of the Republic of Kazakhstan  
T. Duissenova  
June 24, 2015*

*Ye. Dossayev*

Approved by  
Decree of the Minister  
of National Economy  
of the Republic of Kazakhstan  
of June 23, 2015, No. 440

## **Rules for investigation of cases of infectious and parasitic, occupational diseases and intoxication of population**

### **1. General**

1. These rules for investigation of cases of infectious and parasitic, occupational diseases and intoxication of population (hereinafter- Rules) define the investigation procedure of cases of infectious and parasitic, occupational diseases and intoxication of population by the specialists of sanitary and epidemiological service.
2. Cases of infectious and parasitic, occupational diseases and intoxication of population are subject to investigation by the specialists of local subdivisions of the state body administration in the sphere of sanitary and epidemiological welfare of population except for medical cases caused by human immunodeficiency virus, which investigation is conducted by the specialists of health care organizations engaging in activities in the field of prevention and control of Acquired Immunodeficiency Syndrome.

### **2. Procedure for investigation of cases of infectious and parasitic diseases of population**

3. Specialists of the local subdivisions of the state body administration in the sphere of sanitary and epidemiological welfare of population, within 7calendar days upon receipts of emergency notices, conduct epidemiological investigation of cases of infectious and parasitic diseases of population.

4. When registering the fatal cases, and 3 and more cases of infectious and (or) parasite diseases related between each other and registered in one incubation period the epidemiological investigation is held within 24 upon filing the last emergency notice.

5. When registering rare, Kazakhstan-liquidated or de novo infectious and parasitic diseases of population the local subdivision of the state body administration in the sphere of sanitary and epidemiological welfare of population creates headquarters which include the specialists of



the local subdivisions of the state body administration in the sphere of sanitary and epidemiological welfare of population, the center of sanitary and epidemiological examination, if necessary, the representatives of republican bodies and organizations of state body in the field of sanitary and epidemiological welfare of population, the scientific and research institutions.

In the headquarters there are created the groups of:

1) the epidemiological investigation and analysis, which includes the experts as epidemiologists/parasitologists;

2) laboratory diagnosis, which includes the doctors - bacteriologists/virologists, doctor-laboratory assistants;

3) case detection and treatment which includes doctors of healthcare organizations (infectious disease specialists, therapists, pediatricians, neurologists, family doctors and other experts);

4) sanitary and hygienic control, which includes sanitary doctors by sanitary profiles;

5) disinfection, which includes infection disease doctors, disinfectors.

6. In the course of epidemiological investigation the epidemiologist (parasitologist) analyzes clinical aspect of cases of infectious and parasitic diseases of population, to do so, reviews in the medical institutions getting the medical documentation, talks with the doctors of this institution, polls patients and exposed persons, analyzes the available laboratory data and makes sampling from storm center for sanitary and epidemiological examination. He organizes laboratory examination of exposed persons to find the infection source (bacteriological, virology, serology and other). Most important symptoms and indications are detailed (characteristic and the maximum number of stools within 24 hours, the temperature curve and other) in the map of epidemiological examination of storm center, to be approved by the state authority in the field of sanitary and epidemiological welfare of population under subparagraph 2) Article 7-1 of the Code of the Republic of Kazakhstan of 18 September 2009 "On people's health and healthcare system (hereinafter - Code).

In collaboration with laboratory employees the accuracy of laboratory diagnostics is estimated by the criteria as below:

1) equipment capability of the laboratory, timely verification of measuring instruments;

2) compliance with laboratory assessment methodologies approved by the agencies of state body in the field of sanitary and epidemiological

welfare of population and (or) included in the state measurement system registry;

3) quality of used media, agglutinated serums, diagnosticums, test systems (shelf life, compliance with storage requirements, growth factor);

4) completeness and quality of intralaboratory control;

5) level of proficiency of working laboratory staff.

Etiological explanation of diagnosis requires investigating the material from patients according to current methodical documents. If necessary, research is held at regional Sanitary and Epidemiological Examination Center laboratory, obtained pathogenic cultures are sent for identification to the relevant reference laboratory.

Final diagnosis is established on basis of clinical and laboratory data obtained at patient examination, epidemiological anamnesis and data of patients interviewing.

7. When interviewing the patients and exposed persons, the epidemiologist (parasitologist) finds out following:

1) set of people with similar disease symptoms with whom there was a contact in incubation period;

2) the surname, first name, date birth, place of residence, contact phone, place of work/school;

3) the date of disease onset (for diseases with short incubation period \_\_ exact time of disease onset), hospitalization date, hospitalization place, major symptoms of disease;

4) information about anticipated sources, factors and ways of infection transmission;

5) the date of the last visits of organized collective, departure outside the community, region, country;

6) information about received preventive vaccinations.

When registration of imported case of infectious and (or) parasitic diseases one must clear up:

1) terms of patient's visits at endemic countries within the last 3 years;

2) movement of a patient within the Republic of Kazakhstan and a region, district in the period from the moment of case before making diagnosis in the epidemiological season;

3) the febrile diseases of unknown origin over the last 3 years and fevers over the last 3 days;

4) whether there has been any blood transfusion over the last 3 months;

5) whether they have visited the settlement where cases of zoonotic and quarantine diseases are registered, there were visits of large groups of population (seasonal workers, migrants) among of which could be parasitic carriers or originator sources.

8. In the case of registration of quarantine infections, highly dangerous diseases, and also group diseases the local subdivisions of the state body administration in the sphere of sanitary and epidemiological welfare of population arranges detours of homesteads.

If patient visited organized group or epidemiologically significant object (where there could be further spread of infection) in incubation period/disease within 7 calendar days upon emergency notices the local subdivisions of the state body administration in the sphere of sanitary and epidemiological welfare of population organizes and conducts object examination and sanitary-epidemiology and sanitary-preventive activities to prevent further disease distribution.

By results of object examination at the day of completion of check there is documented a sanitary and epidemiological examination certificate in due form approved by state body in the field of sanitary and epidemiological welfare of population under subparagraph 2) Article 7-1 of the Code.

Results of the epidemiological investigation are recorded in the map of epidemiological examination of infectious diseases focus (hereinafter – EEIDF Map), to be approved by state body in the field of sanitary and epidemiological welfare of population in accordance with subparagraph 2) Article 7-1 of the Code.

9. To establish the infection source the laboratory examination of exposed persons and people supposedly related to spread of infection is held by epidemiological indications.

10. If there is a suspicion of the infection source among the decreed contingent the latter are stood off work by the order of the object CEO or the decrees of local subdivisions of the state body administration in the sphere of sanitary and epidemiological welfare of population until the results of laboratory examination are obtained and the hazards for population are excluded.

11. If suspect, a source infection of product or raw materials, served as reason for intoxication, made and(or) was received from another region, healthcare organization immediately informs of the disease to local subdivisions of the state body administration in the sphere of sanitary and epidemiological welfare of population for placing sanitary-epidemiological and sanitary-preventive activities.

### **3. Procedure for investigation of cases occupational diseases and intoxication of population**

12. Diagnosis of acute occupational diseases (intoxication) is made by medical organizations providing outpatient-polyclinic and hospital care to citizens (hereinafter - Medical organization), diagnosis of chronic occupational diseases (intoxication) – healthcare state organization providing special medical care in the field of occupational pathology and examination.

13. Acute and chronic occupational diseases (intoxication) associated with exposure to employee of harmful occupational factors due to performance by an employee of his/her labor (official) duties are subject to investigation and recording.

14. For each case of acute occupational diseases (intoxication) the Medical organization files medical documentation “Emergency notice about infectious disease, food, acute professional intoxication, unusual reactions to inoculation” (hereinafter - emergency notice) approved by state authority in the field of sanitary and epidemiological welfare of population in accordance with subparagraph 2) Article 7-1 of the Code.

15. Emergency notice of establishing pre-diagnosis of acute (within a day) occupational diseases (intoxication) an employee is sent to local subdivision of the state body administration in the sphere of sanitary and epidemiological welfare of population, meanwhile this is reported to an employer (policyholder), who, in his turn, is obliged to notify of suspected insurance event with reference of occupational disease of an insurer.

16. When updating or changing the diagnosis the Medical organization prepares new emergency notice and within 24 hours send it to employer and to local subdivision of the state body administration in the sphere of sanitary and epidemiological welfare of population at the patient’s job address whereby altered (updated) diagnoses and date of establishment are specified.

17. The document establishing professional character of disease (intoxication) onset with the employee is the workplace accident act (hereinafter - Act), compiled by employer by results of investigation in a form approved by the order of the Minister of Labor and Social Protection of the Population of The Republic of Kazakhstan of 3March 2009 No. 74 “On approval of forms of documents related to workplace accidents” registered in the Registry of state registration of regulatory legal acts under No. 5614.

18. In the course investigation the commission identifies the circumstances and causes of onset of the occupational diseases

(intoxication) case, the specialists of local subdivision of the state body administration in the sphere of sanitary and epidemiological welfare of population compile sanitary and epidemiological characteristic of employee's labor conditions by results of investigation.

19. On the basis of clinical data of employee's health, sanitary and epidemiological characteristic of employee's labor conditions act the Medical organization makes final diagnosis \_\_\_\_\_ acute occupational disease (intoxication), issues medical conclusion, sends, to local subdivision of the state body administration in the sphere of sanitary and epidemiological welfare of population, the employer, the notice of final diagnosis of acute occupational diseases (intoxication), and also data of its update or cancellation, name of harmful occupational factors and causes of occupational disease (intoxication).

20. Final diagnosis of acute occupational diseases (intoxication) require no confirmation and is not a ground for application to healthcare organization providing medical care by professional pathologies to population of the Republic of Kazakhstan. It concerns to infectious professional pathologies too - diagnosis of first infectious diseases, as usual, indicates he acute nature of disease.

21. When the Medical organization identifies indications of persistent disability due to acute occupational diseases (intoxication) an employee (insured) with sick slip documented is referred to an healthcare organization providing medical care on professional pathologies to population of the Republic of Kazakhstan for expertise of temporal disability.

22. State healthcare organization providing special medical care in the field of occupational pathology and expertise on the basis of clinical data of state of employee health and documents submitted makes final diagnosis - chronic occupational disease, intoxication (including that arisen after long period after termination of work in contact with harmful substances or production factors), draws up a conclusion report and within 3 business days send a notice to local subdivision of the state body administration in the sphere of sanitary and epidemiological welfare of population, the employer and to Medical organization.

23. Referral to Healthcare organization providing medical care on occupational pathologies to population of the Republic of Kazakhstan is documented by the conclusion of medical consultative board of the Medical organization having set the provisional diagnosis of chronic occupational diseases (intoxication) caused the temporary disability, with a mark in sick clip.

24. Closing the sick slip or execution of referral to sociomedical expertising is conducted by the Medical organization, which made provisional diagnosis of chronic diseases (intoxication).

25. The main document that is used at making diagnosis of occupational diseases (its relation to the work or occupation) is the Entry of occupational diseases and intoxication according to Annex 1 to these Rules.

26. Chronic occupational diseases (intoxication), and consequences of acute occupational intoxication are established at the profile expert commissions on occupational pathologies (hereinafter - ECOP) created by the healthcare organization rendering medical care on occupational pathologies to population of the Republic of Kazakhstan.

27. Total number of ECOP members is at least 3 persons, which Chairman is appointed the occupational physician with qualification category, being also an expert by diseases profile, holding academic degree. Commission members are the pathologists and doctors by disease profile with professional certificates. The doctors of disease profile (not being the members of commission) are involved, if necessary.

28. ECOP conducts primary expert evaluation of diseases (intoxication) relation to employee's performance of labor (official) duties and determining the degree of functional disorders.

29. ECOP considers the materials on primary establishment of the diagnosis of chronic occupational disease (intoxication) subject to the documents below:

- 1) the referral of the Medical Organization;
- 2) the conclusion of the medical consultative board;
- 3) extract from medical records (outpatient, inpatient) with data of preliminary physical examinations and periodic medical examinations, the results of laboratory and functional examination;
- 4) The original medical record of outpatient from place of residence;
- 5) The sanitary and epidemiological characteristics of labor conditions;
- 6) Document confirming the labor activities of the worker.

30. When the primary expert evaluation of relation of diseases (intoxication) to employee's performance of job (official) duties the ECOP adopts the decisions as follows:

- 1) disease relates to exposure to occupational factors;
- 2) disease does not relate to exposure to occupational factors;
- 3) requiring additional information (specify which), upon representation of which there will be held re-consideration of the case;
- 4) required a second medical examination in (indicated) period with re-examination of the case.

31. The ECOP defines a form of re-examination of materials (in presentia, in absentia).

32. In the initial establishment of chronic occupational disease (intoxication) a notification of chronic occupational disease (intoxication) is documented by the form according to Annex 2 to these Rules.

33. Notification of chronic occupational disease (intoxication), within three calendar days, is sent to the employer by address of the last place of work of the patient in contact with harmful occupational factors, to the local subdivision of the state body administration in the sphere of sanitary and epidemiological welfare of population and Medical organization.

34. ECOP conclusion is documented as a protocol by form according to Annex 3 to these Rules. Protocol is issued to the patient or his trusted person.

35. When re-examining the chronic occupational disease (intoxication) the ECOP takes the decisions as below:

1) deterioration course (progress) of chronic occupational disease (intoxication);

2) stabilization or regression of chronic occupational disease (intoxication);

3) the residual effects of an occupational disease (intoxication) with indication of the degree and severity;

4) removal of chronic occupational disease (intoxication).

36. After the establishment of chronic occupational disease (intoxication) data of the patient are recorded in the records log of individuals with the newly diagnosed occupational disease as per the form according to annex 4 to these Rules.

37. In the case of difficulties with defining relation of disease (intoxication) with employee's performance of job (official) duties or disagreement of the employee, the employer, the insurance company with the ECOP conclusion, when settling the matter of relation of disease (intoxication) with employee's performance of job (official) duties, within 10 business days, the medical documents of the patient are forwarded to Republican expert dispute commission on occupational pathology for consideration (hereinafter - REDCOP), created by the authorized body in the field of healthcare and social development of the Republic of Kazakhstan.

38. REDCOP examines the documents as soon as available, invites the disease profile doctors to meeting, requests documents from organizations, necessary for establishing diagnosis of occupational disease (intoxication).

39. REDCOP considers the following documents:

1) the referral (a letter, a claim and other applications);

2) ECOP protocol;

3) medical documents of the patient;

4) the sanitary and epidemiological characteristics of job conditions;

5) document confirming the labor activities of the employee;

6) additional documents obtained at request.

40. Upon receipt of requested documents REDCOP holds repeated in-presentia or in-absentia meeting with making decision of:

1) a disease is associated with exposure to occupational factors;

2) Disease is not associated with exposure to occupational factors;

3) removal of chronic occupational disease (intoxication).

41. REDCOP conclusion is documented as a protocol with an indication of the clinical diagnosis, complications, functional disturbances, labor and medical recommendations by rehabilitation. Protocol is issued to the patient or to his/her trusted person.

42. If REDCOP establishes primary chronic occupational disease (intoxication) a notification of chronic occupational disease (intoxication) as per the form according to annex 2 to these Rules is issued.

43. When establishing the diagnosis of occupational disease (intoxication) it is required to take into account the nature of the clinical forms of the disease, the nature of the active etiological factor and performed job, sanitary and epidemiological conditions of production environment and labor process, work experience in harmful and hazardous labor conditions. If there were no research of production environment, it shall not prevent establishing the diagnosis of occupational disease (intoxication), since meanwhile the data of scientific literature (subject to their availability and relevance), modeling and extrapolation of similar production conditions may be used.

44. If there are multifactorial reasons for disease and they include a professional factor too, the disease is considered to be occupational. Some occupational diseases: silicosis, berylliosis, papilloma of the urinary bladder, malignant neoplasms may develop over the long term after termination of work contacting with harmful, hazardous substances and production factors.

When determining the chronic occupational disease (intoxication) of allergic, infectious nature a contact with acting agent, particularly of clinical manifestations has value. Job experience is not taken into account.

45. Notification of diagnosis change or cancellation is sent the healthcare organization rendering medical care by occupational disease to population of the Republic of Kazakhstan, to local subdivision of the state body administration in the sphere of sanitary and epidemiological welfare of

population, the employer and health organization within 7 business days upon adoption of the relevant decision.

46. Employer, within 10 business days upon obtaining notification of final diagnosis of occupational disease (intoxication), creates a commission for investigation of occupational disease (intoxication), headed by the employer.

47. Investigation of each case of acute or chronic occupational disease (intoxication) is held by the Commission under the Order issued by the employer upon obtaining emergency notification of final diagnosis, with subsequent written notification to all members of the Commission:

1) immediately – of acute occupational disease (intoxication) with the loss of ability to work with the number of cases (affected) of 2 people and over, with a fatal case, highly infectious disease. Chairman of the commission is the State labour inspector (in the case of highly infectious diseases – chief state sanitation physician or his deputy on appropriate territory or transport);

2) within 24 hours - provisional diagnosis of acute occupational disease (intoxication). Chairman of the Commission is the employer (the CEO of organization or his Deputy);

3) within 10 business days – of chronic occupational disease (intoxication). Chairman of the Commission is the employer (the CEO of organization or his Deputy).

48. The Commission includes a representative of the employer, OHS specialist (or person designated by the employer responsible for OHS), the representatives of the Medical Organization, the local subdivision of the state body administration in the sphere of sanitary and epidemiological welfare of population, the trade union or other authorized staff representative body. In disputes the investigation may involve other specialists.

The members of the Commission carry out an investigation of occupational disease (intoxication) only at the composition of the commission. Conducting by the commission members of independent individual investigation is not allowed.

49. To hold an investigation the employer:

1) presents documents and materials, including archival characterizing the labor conditions on working place (site, in the shop);

2) conducts, by request of members of the Commission, at his own expense, necessary examination, laboratory and instrumental and other hygienic examinations to assess labor conditions on work place;

3) provides the safety and accounting of investigation documents.

50. Occupational disease onset with the employee sent for execution of work to another organization is investigated by the Commission formed at that organization, where there took place the specified case of occupational disease (intoxication). The commission includes authorized representative of the employer (organization, individual entrepreneur) having sent the employee. Non-arrival or late arrival of the authorized representative of the employer is not a ground for change the timing of the investigation.

51. Occupational disease onset with the employee at performing combining jobs is investigated and recorded at the place, where the combining job was conducted.

52. The investigation of the circumstances and the reasons for the onset of chronic occupational disease (intoxication) with individuals not having a contact with harmful productive factor at the time of investigation, which caused this occupational disease, including with those who are unemployed, is held at the place of the former job with harmful productive factor.

53. During the investigation the commission interviews fellow workers, individuals committed a violation of the requirements of documents of state sanitary and epidemiological standards systems, receives the necessary information from employer and diseased.

54. During the investigation:

1) the circumstances and reasons for the onset of occupational disease (intoxication) are clarified;

2) a survey of working space (the working area, production area, shop), where there was a disease onset is conducted;

3) if necessary, laboratory and instrumental research of harmful production factors is organized;

4) the sanitary and epidemiological labor conditions of the employee are estimated;

5) the acts of sanitary and epidemiological examinations of the organization, the results of laboratory studies, certification of work places are studied;

6) materials preliminary and periodic medical examinations, plan of activities for improvement of patients identified during periodic medical examinations, information of implementation of the plan to improve conditions, protection of labor and sanitation-recreational activities are studied.

55. Organization, which is addressed an inquiry, within 15 calendar days, must provide copies of requested documents necessary for investigation.

56. Acute occupational disease is simultaneously investigated as on-the-job accident.

57. To adopt decision by the results of the investigation there are required the documents as follows:

1) Order of creating a commission to investigate occupational disease (intoxication);

2) sanitary and epidemiological characteristics of labor conditions of the employee;

3) information of conducted medical examinations, plan of activities on health improvement of patients identified at periodic medical examinations;

4) extract of registration logs of briefings and knowledge assessment protocol of the employee on protection of labor;

5) protocols of employee's explanations, inquiry of individuals having worked with him/her, other persons;

6) expert conclusion, the results of investigation and experiments;

7) Medical records of the nature and the degree of severity of damage caused to health of the employee;

8) copies of the documents confirming the issuance to employee of personal protection equipment;

9) extract from instructions previously issued to this production (object) by the territorial unit of agency of state body in the field of sanitary and epidemiological welfare of the population and state authority in the field of protection of labor;

10) other materials by the discretion of the Commission.

58. By the results of the investigation of the case of occupational disease (intoxication), within 3 business days upon expiration of investigation term the committee prepares the Act intended for employee, employer, local authority on labor inspection, local subdivision of the state body administration in the sphere of sanitary and epidemiological welfare of population and Medical organization. The Act is signed by the members of the Commission, approved by the employer and certified with the employer's seal (if any).

59. By its legal force and designation the Act does not establish and cancel the diagnosis of occupational disease (intoxication), and only establishes and confirms causal relationship of this disease with harmful labor conditions, duration and intensity of their exposure at the place of work of diseased employee (insured).

60. If the Commission finds, that the gross negligence of the insured has contributed to the onset or increase of the damage caused to his health,

and then given the conclusion of the trade union or another authorized body the Commission establishes the degree of guilt of the insured.

61. In the case disagreement of employer (his representative, the injured employee) with the content of the Act and refusal to sign he (they), with setting out their objections in writing, attach them to the Act and send it to superior by subordinate bodies and institutions.

62. If necessary, the Act is recovered or re-drawn up by the results of a retrospective investigation of the occupational disease (intoxication), regardless of time limitation of the occupational disease (intoxication) taken place and diagnosed as established, or duplicate of this Act sealed and signed by the head, is issued.

63. If organization (company) has been liquidated the Act is prepared by the commission created by order of the legal successor.

The commission for investigation includes a representative of the employer, OHS specialist (or person designated by the employer as responsible for OHS), the representative of healthcare organization, representative of the local subdivision of the state body administration in the sphere of sanitary and epidemiological welfare of population, a representative of the trade union or other authorized staff representative body. If necessary, it may involve other specialists.

64. If relation of infection diseases or parasite diseases with labor conditions is confirmed an investigation of this case is held by local subdivision of the state body administration in the sphere of sanitary and epidemiological welfare of population.

65. The main document, which establishes the potential infection with infectious or parasitic disease when performing occupational duties, is the IDFEE map.

66. IDFEE Map is application to the act and is kept together with it. Map of epidemiological examination is prepared for : Medical Organization established the diagnosis of infectious or parasitic diseases, local subdivision of the state body administration in the sphere of sanitary and epidemiological welfare of population, the healthcare organization providing medical care on occupational disease to population of the Republic of Kazakhstan, employer and employee.

67. If location and actual address of the employer and other locations of job (study), where a victim is working or worked, are different, are in different areas, regions and cities, investigating the case of occupational disease (intoxication), drafting of the Act, registration and record of case are held by the actual location of the object, where took place the occupational disease (intoxication).

The sanitary and epidemiological nature and Act specify the actual location of job of affected and legal address of the employer.

68. If the onset of professional disease (intoxication) was associated with the influence of harmful production factors at work on objects controlled by different local subdivisions of the state body administration in the sphere of sanitary and epidemiological welfare of population, having received notice about preliminary diagnosis of occupational disease (intoxication), the local subdivision of the state body administration in the sphere of sanitary and epidemiological welfare of population at last job place, prepares sanitary and epidemiological characterization of labor conditions (if necessary – based on materials derived from respective territorial units of agency of state body in the field of sanitary and epidemiological welfare of the population and other organizations under official requests).

69. When verifying an event of the insurance nature of disease (intoxication) the insurer establishes causal relationship of occupational disease (intoxication) with production, evaluates medical documentation (medical records of outpatient or stationary patient), details about diseases of the insured and their causes contained therein, about the frequency of complaints, the clinical manifestations of disease, medical history and other data enabling to establish relation of diseases with occupational activities. The factors and reasons, which caused occupational disease (intoxication) are compared with data medical documentation, sick slip, sanitary and epidemiological characteristic of employee's labor conditions.

70. Act along with the investigation materials is stored by the employer.

71. Within a month upon completion of investigation the employer develops the plan of activities based on the act to prevent occupational disease (intoxication) and to improve labor conditions and sanitation-recreational activities.

The employer reports to local subdivision of the state body administration in the sphere of sanitary and epidemiological welfare of population about execution of the decisions of the commission and plan of activities to prevent occupational disease (intoxication) and improve labor conditions and sanitary-recreational activities in writing.

72. Follow-up care of a patient with occupational disease is provided by the Medical Organization at the place of his residence.

**List of occupational diseases and intoxications**

No.	Name of diseases according to the classification of the International Classification of diseases of the World Health Organization X review (hereinafter - МКБ 10:)	Dangerous harmful substances and production factors which influence may result in contraction of occupational diseases	Approximate list of works arranged
1. Diseases caused by influencing of chemical agents			
	Acute intoxications, chronic intoxications (МКБ 10:T36-T65) and their consequences (МКБ 10:T95-T98), proceeding with focal lesion or coexistent affection on organs and systems	Chemical agents: source material, intermediate, by-products and final products	All types of work related to the processes, reworking, application (including laboratory works) of chemical substances with toxic effect in different branches of industry, construction, agriculture, transport, and services sector
1)	Toxic damage of respiratory organs, rhinopharyngo-laryngitis, anabrosis, nasal septum perforation, tracheitis, bronchitis, pulmonary fibrosis and other (МКБ 10:J 68-J68.9)	Acidum nitricum, ammonia, nitrogen oxides, isocyanate, organic silicon compound, selenium, sulphur and its compounds, formaline, phthalic anhydride, fluorine and its compounds, chloride and its compounds, chrome and its compounds,	

	phenol, and others
Toxic anemia (МКБ 10:L64/8)	Amino-, nitro-, and chlorine compounds of aromatic series, benzol and its compounds, benzol homolog, hexamethylene diamine, pesticide (organochlorine), lead and its inorganic compounds
Alimentary organs intoxication: toxic damage of liver and gall bladder (МКБ 10:K.71, K71.0-K71.5, K82.8-K82.9, 83.8); gastritis, duodenitis, stomach and gall bladder erosive canker, colitis (МКБ 10:K20, K22.8 K25, K29.9; K52.1, K87.0)	Amino-, nitro-, and chlorine compounds of aromatic, benzol and its compounds (styrole), halogen derivatives of fatty carbons, hydrazine and its compounds, pesticide (organochlorine), phosphorus and its compounds, fluorine and its compounds
Toxic nephropathy (МКБ 10:N28.9, 28.8)	Betanaphthol, cadmium, carbon tetrachloride
Toxic damage of nervous system: polyneuropathy (МКБ 10:G62.2), neurosis-like states (МКБ 10:G90.9), encephalopathy (МКБ 10:G92)	Amino-, nitro-, and chlorine compounds of aromatic, hexamethylene diamine, benzol and its compounds (benzol homolog, styrole), halogen derivatives of fatty

	carbons, hydrazine and its compounds, pesticides, mercuric and its compounds, carbon sulphide, lead tetraethide and many others, fluorine and its compounds, phosphorus and its compounds, lead and its compounds, phenol	
Toxic damage of eyes: cataract (МКБ 10:H26.8-H26.9);	Trinitrotoluol, Acidum nitricum, ammonia, nitrogen oxides, isocyanates, phenol	
Conjunctivitis, keratoconjunctivitis (МКБ 10:H10.8-H10.9, H16.2)	Sulphur and its compounds, formaline, fluorine and its compounds, chloride and its compounds, phenol	
Toxic damage of bones: as osteoporosis (МКБ 10:M82)	Yellow phosphorus and its compounds, fluorine and its compounds	
2) Skin diseases: epidermolysis (МКБ 10:L18.1), contact dermatitis (МКБ 10:L23, L24, L25), photocontact dermatitis (МКБ 10:L56), onychia (МКБ 10:L60.8), paronychia (МКБ 10:L60.8), toxic melasma (МКБ 10:T53), oil	Products of distillation, coal and slates (petrol, kerosene, lubricants, cresol, lysol, tar, fuel oil, asphalt, artificial asphalt and its condensates), chlorinated	Enterprises of chemical, oil refining, machine-building, metallurgical, woodworking, raw leather, leather, and food industry, oil carrier cleaning; construction, furniture manufacture, shaft



	folliculitis (МКБ 10:L73.8)	Naphthalenes, acids, alkali, organic solvents, hydrosulphate, bleach powder, salt of heavy metal, arsenic compounds, antimony compounds, formalin, and glue.	contractors.
	Occupational white leprosy (МКБ 10:L80)	Para tertiary butyl phenol Low para alkyl and para alkoxyphenols, 4-alcipatechin	Production and application of para tertiary butyl phenol for obtaining of a resin, lacquer, and enamels. Production of phenol-containing oil and fuel additives
3)	Metal-caused fever (МКБ 10:T56), polymer fume (teflon) fever (МКБ 10:T65.8)	Non-ferrous metal aerosol spray condensations (zinc, copper, nickel, antimony and others), derivative polymerization aerosols (ftoroplast)	Manufacture of non-ferrous metals, plastic mass (ftoroplasts) and their processing, non-ferrous metal materials reprocessing.
2. Diseases caused by influencing of industrial aerosols			
1)	Dust disease: carbon pneumo coniosis (МКБ 10:J60); asbestosis (МКБ 10:J61); silicosis, talcosis (МКБ 10:J62); aluminosis ((МКБ 10:J63.0), bauxite fibrosis (light) (МКБ 10:J63.1), berylliosis (МКБ 10:J63.2), graphitic	Long inspiration of dust that contents silicon dioxide in free or compound state, mine, X-ray contrast, dust containing carbon (coal, cox, soot, graphite, and other); hard and heavy	Work in ore mines, coal mines, opened carriers, concentrating patients of metal and coal mining industry; mining, processing of rock products and materials, asbestos and other silicates, crushed stone and so

	fibrosis (МКБ 10:J63.3), siderosis (МКБ 10:J63.4), staniosis (МКБ 10:J63.5), pneumo coniosis in planishers or producers of emery, cement and other types of mixed dust (МКБ 10:J62.8; J63.8); and other pneumo coniosis from X-ray contrast dust (МКБ 10:J63.8); Baritosis and other hypersensitivity pneumonitis (МКБ 10:J64; J65; J67)	alloys; aerosol for welding, dust of organic and artificial mineral fiber, plastic, including a sow of inhaled aerosol by microflora	on; production of asbestos cement and other materials containing asbestos (pipes, roofing slate, panels, planks, friction and asbestos-reinforced laminates production and others), production of white ware, glass goods, use of refractories and abrasives; production and use of coke, soot, graphite; metallurgy and foundry works, machinery construction; metal-working; welding; grinding of loose materials; production, processing of plastic, agricultural and other kinds of works with dust release
2)	Bisynos (МКБ 10:J66.0)	Long inhalation of various kinds of fibrous plant dust (flax, cotton, hemp)	Processing of cotton, flax, hemp at production of textiles

3)	Occupational bronchitis (dust, toxic-dust): dust nonobstructive bronchitis (МКБ 10:J41.0); dust obstructive bronchitis (МКБ 10:J44.8); toxic-dust nonobstructive bronchitis (МКБ 10:J68.0); toxic-dust obstructive bronchitis (МКБ 10:J68.0)	Long inhalation of all kinds of dust said above and also organic dust of phytogenous and animal origin (flour, grain, hair, wool, tobacco, paper, sugar and others). Simultaneous action of dust and chemical factors (irritating materials, components of self-propelled mining machines), including explosive gases combined with unfavorable microclimatic conditions	Works listed in subparagraph 2) column 4 as well as manufacture: felt-making, flour-and-cereals, sugar industry, pharmaceutical, wool, primary processing of cotton, flax and other fiber crops, as well as other kinds of works connected with dust release.
4)	Pneumonomycosis (mycotoxicosis (МКБ 10:B44.8, B48.8), actinomycosis (МКБ 10:A42.0)	Contact with a sow mycetology, mine water and inby equipment, organic dust of vegetable and animal origin (flour, grain, wool, tobacco)	Work in ore mines, coal mines, agricultural (processing of flax, cotton, textile) and other kinds of works with dust release
5)	Total dystrophic upper respiratory tract diseases (chronic subatrophic and hypertrophic rhinopharyngitis) (МКБ 10:J31.0-J32.9)	Inhaling of dust specified in subparagraph 2) column 3	Works specified in subparagraph 2) column 4
3. Diseases caused by effects of physical factors			

1)	Diseases associated with effects of ionizing radiation (МКБ 10: W88):	A single short-term general effect of external ionizing radiation or ingestion of significant amounts of radioactive substances and their compounds	All kinds of work with radioactive substances and sources of ionizing radiation
	Radiation sickness (acute or chronic) (МКБ 10: W88, W90)	Systematic effects of ionizing radiation at doses exceeding those permissible for occupational exposure	
	Local radiation injuries (acute or chronic) (МКБ 10: W88, W90)	External local effect of penetrating radiation, effect of radioactive substances	
2)	Diseases associated with effect of non-ionizing radiation: vasomotor dyscrasia, asthenic, asthenovegetative, diencephalic syndromes (МКБ 10: W90)	Systematic effect of S-band electromagnetic radiations; coherent monochromatic radiation	All types of work with sources of S-band electromagnetic radiation; all types of work with the emission of optical quantum generators
3)	Local tissue damage by laser radiation (skin burns (МКБ 10: L59), keratopathy (МКБ 10: H18.8), retinal disorder (МКБ 10: H35.8)	Local effects of laser radiation	All types of work with the emission of optical quantum generators
4)	Vibration disease (МКБ 10:T75.2)	Long-term systematic effect of industrial local vibration transmitted to the	Work with hand-held machines that generate vibration and workstations that generate vibration

		hands of workers, and the general vibration of workplaces	
5)	Perceptive hearing loss (МКБ 10:H90.3; H90.6)	Systematic effect of occupational noise	All types of labor activity associated with the effect of intensive occupational noise, in industry, construction, agriculture, transport, communications
6)	Vegetative-sensory (angioneurosis) polyneuropathy of the hands(МКБ 10:G62.8)	Contact ultrasound transfer to the hands	Work with ultrasonic flaw detectors and medical equipment
7)	Actinic ray ophthalmia (МКБ 10: H57.8)	Intensive ultraviolet radiation	Work associated with gas and electric welding, and in conditions of intense ultraviolet radiation
8)	Cataract (МКБ 10:H26.8)	Systematic effect of radiation energy (infrared, ultraviolet radiation, microwave radiation, X-ray, gamma rays, neutron, proton radiation)	Forging and pressing, electro-welding and thermal works, production of glass products, works associated with infrared radiation in metallurgy, with effect of ionizing and non-ionizing radiation
9)	Decompression (caisson) disease and its consequences (МКБ 10: T70.3)	High atmospheric pressure, decompression processes	Works in caissons, pressure chambers, diving and other work in conditions of high atmospheric pressure.
10)	Heat exposure: heat apoplexy, Convulsive state (МКБ 10:T67.0;	Increased temperature and intense heat	Work in deep mines, foundry open-hearth, sheet rolling, tube-

	G40.5; G40.6)	radiation in the work area	rolling shops; repair of industrial furnaces, cleaning of furnaces, boilers, glass melting, other work at increased temperature
11)	Obliterating endarteritis (МКБ 10: I73.9), Vegetative-sensory (angioneurosis) polyneuropathy (МКБ 10: G62.8)	Low temperature in the work area	Work on fishing ships, fishing industry; refrigerators; geological work; at logging camps; work in the conditions of wet and permafrost; peat extraction, mining mines; work in conditions of watered workings and permafrost; mine oil production and other types of work at low temperature in the work area
12)	Onychodystrophy (МКБ 10: L60.3), mechanical epidermoses (callosity and others) (МКБ 10: L60.3)	Fleshing, temperature and meteorological factors	leather and fur production, agricultural work (field) work on ships and onshore processing enterprises
4. Diseases associated with physical overworks and overstress of certain organs and systems			
1)	Coordination neuroses, including graphospasm (МКБ 10: F48.8)	Work that requires high coordination of movements which shall be carried out at a quick rate	Work on keyboards and musical instruments; stenography, handwritten, typewritten, drawing, engraving, copying works
2)	Peripheral nervous	Work associated	Grinding, molding,

disease: Mono- and poly- neuropathies, including compression and vegetative-sensory polyneuropathies of the upper extremities (МКБ 10: G56, G57, G58.8 G62.8)	with staticodynamic loads on the shoulder girdle, repeated arm movements, pressure on the nerve cords in combination with microtraumatism, cooling	painting, plastering, sewing works, shoe production, manual milking, workers of mining, metallurgical, petroleum and chemical industries
Cervico-brachial, lumbosacral radiculopathy (radicular ischemia) (МКБ 10: M54.1)	Work associated with the systematic body bents, staying in a constrained working posture (with forward bend, in suspension, on the hunkers, lying, etc.); as well as in combination with physical muscle tension. Work associated with the effects of general vibration and shaking	All types of work in tunneling and breaking faces, including in flooded conditions with an unfavorable microclimate; anchor works associated with systematic lifting, carrying heavy weights in the constrained body posture, drivers of underground transport: a driver of underground installations (control), drivers of underground heavy duty vehicles
Cervical and lumbosacral radiculomyelopathy (МКБ 10: M50.0, M51.0, M51.1, M50.1)	Work associated with lifting, carrying heavy loads, prolonged stays in the constrained position of the body, systematic body	The work specified in subparagraph 2) item 4. Cervicobrachial, sacrolumbar radiculopathy (МКБ 10: M54.1), column 4, rolling, blacksmithing,

		bents, staying in a constrained working posture with the body bend and bend of the head (flexion, overextension, turns); micro- and macro-traumatism	riveting, trimming, construction work; drivers of heavy-duty self-propelled and agricultural machines, circus and loading and unloading operations
3)	musculoskeletal system disorders: Chronic myofibrosis of forearms and shoulder girdle, myofasciitis, fibro myofasciitis, vegetomyofasciitis (МКБ 10: M62.8); tendovaginitis (МКБ 10: M65.8)	Work associated with local and regional muscle tension; the same type of movements performed at a quick rate; pressure on the nerve trunks, muscles, bands, chorda, their traumatism; systematic balancing of goods, keeping the goods in hands, lifting them, moving them manually or by applying efforts	Works on keyboard, computer, typewriter, mining, grinding, drilling, blacksmithing, riveting, trimming, molding, painting, musical, engraving, copy operations, handwritten operations, shorthand
	Stenotic ligamentosis, styloidosis (ulnar, brachial), epicondylosis (МКБ 10: M77.0)	Work associated with systematic pressure on the ligaments, frequent flexion of the forearm in combination with its pronation and supination, rotational movements and drawing back of	Forging, drawing, plastering, wrapping- insulating, painting, various work on cutting of piece goods, shoes

		the hand	
	Periarthrosis (humeroscapular, elbow, knee) arthropathy deformans (the same localization) with functional impairment; bursitis, aseptic osteonecrosis (МКБ 10: M19.8)	Work associated with widely-amplitude rotational movements, systematic pressure in the the relevant joints, overtension and traumatism of the latter; different types of work, performed on the hunkers, knees;	Construction, tunneling, drilling, roofing operations, various types of work on production of parquet, granite
4)	prolapse of the uterus and frank prolapse (МКБ 10: №81)	long-term (10 years or more) systematic (more than 50 percent of the time shift) lifting and moving of the weights when combined with a constrained working posture and the effect of vibration or without it in women at the age of 40 in the absence of injury to the pelvic floor muscles during delivery	Work associated with the movement of goods manually or by applying effort
5)	Prominent varicose veins on the legs, complicated by inflammatory (thrombophlebitis) or trophic disorders (МКБ 10: I83.0.-I83.2)	Long stay in constrained working posture upright	Work associated with long-term static stress, standing, systematic carrying of heavy weights
6)	Diseases caused by	The work associated with the	Instructorship, radio announcer, television

	overstress of the vocal apparatus: chronic laryngitis, nodules of vocal cords (“singer’s nodes”) (МКБ 10: J38.2), contact ulcers of vocal cords (МКБ 10: J38.7), (МКБ 10: J37)	systematic vocal apparatus strain	announcer, vocally conversational types of actor’s activity, work at telephone stations
7)	Progressive myopia (МКБ 10: H52.1)	Increased eye strain during distinguishing of small objects from close range	Mapping, work on electronic computers, faceting and quality control of precious stones, watch assembly, proof-reading, working with optical devices
8)	Neuroses (МКБ 10: F40-F48)	Long-term direct service to mentally ill children	The work of health care personnel in psychiatric institutions, including teachers, service staff of special schools for mentally ill children
5. Diseases caused by the effect of biological factors			
1)	Infectious and parasitic diseases similar to the infection with which workers are in contact during work: tuberculosis (МКБ 10: A15-A19), brucellosis (МКБ 10: A23), equinia (МКБ 10: A24), anthrax (МКБ 10: A22), tick-borne encephalitis (МКБ 10: A84), ornithosis, milker's nodules, toxoplasmosis (МКБ 10: B58), viral hepatitis (МКБ 10: B15-	Contact with infectious patients and infected materials or disease carriers, with sick animals, animal and plant products, environmental factors (skin, wool, growth, horse hair, meat, rawstock, fur raw materials, waste, grain, cotton, water, soil etc); contact with	Work at infectious, anti-tuberculosis and dermatovenerologic dispensaries, AIDS prevention and control centers, at medical units and other medical organizations, in clinical, virological, microbiological, parasitological laboratories, health care workers of blood service organizations,

	B19), HIV disease МКБ (10 : B20-B24), dermatomycosis (МКБ 10: B35-B37; B48), Rosenbach's diamond-skin disease (МКБ 10: A26), scabies (МКБ 10: B86), typhoid МКБ (10: A-01.0), syphilis (МКБ 10: A65) and others (МКБ 10: A94)	rodents, contaminated surfaces, contact with sewage; In the case of emergency when working with HIV-infected material	hemodialysis workers, surgeons, specialists of local state body administrations in the field of sanitary and epidemiological well-being of the population, treatment and labour shops for tuberculosis patients, animal husbandry, veterinary services, at sewage plants, meat processing plants, confectionery, canning factories; factories; processing of rawstock and fur raw materials, sea-hunting industry, on ships and onshore enterprises of the fishing industry; various types of work in forestry
2)	Mycosis of open skin areas (МКБ 10: B35-B49)	Contact with contaminated mycology of mine water and equipment in underground workings	Work at mines
3)	Dysbacteriosis, candidomycosis of the skin and mucous, visceral candidiasis (МКБ 10: B37)	Antibiotics, producer-fungi, protein-vitamin concentrates, fodder yeast, mixed fodder	Work in various sectors of the microbiological industry; application in the production of medical industry, in medical

			practice, pharmacy and other organizations of substances specified in paragraph 5, subparagraph 3) of column 3
6. Allergic diseases			
1)	conjunctivitis (МКБ 10: H10.1-H10.3), rhinitis, rhinopharyngitis, rhinopharyngolaringitis, rhinosinusitis (МКБ 10: J30, J30.3)	Substances and compounds of sensitizing action	Works associated with the effect of allergens in various industries (chemical, pharmaceutical, construction, woodworking, metallurgy, mining, oil and chemical industries, rubber equipment, synthetic detergents production, machinery, textile, bristle-brush, fur enterprises, production of mixed fodders, protein-vitamin concentrates and others); in agriculture (poultry factories, farms, work with pesticides); transport; (household cleaners, hairdressers, laundries), medical and pharmacy institutions, in clinical, virological, microbiological, parasitological laboratories,
2)	bronchial asthma, asthmatic bronchitis (МКБ 10: J45.0), drug allergy with clinical manifestations of bronchial asthma (МКБ 10: J70.2, T88.7), exogenous alveolitis (МКБ 10: J67)		
3)	epidermosis, dermatitis, eczema, toxicoderma, (МКБ 10: L23; L24; L25; L27.0; L27.1)		
4)	Quincke's edema (МКБ 10: T78.3), urticaria (МКБ 10: L50), anaphylactic shock (МКБ 10: T78.2)		
5)	toxicallergic hepatitis (МКБ 10: K71)		
6)	erythema multiform (МКБ 10: L51)		

			laboratories of industrial enterprises, institutes, vivariums
7. Tumours			
1)	skin tumors (hyperkeratosis, epithelioma, papilloma, cancer, leukokeratosis) (МКБ 10: C43-C44)	Products of coal distillation, oil refining, shale distillation (resin, coal tar, anthracene, phenanthrene, aminoanthracene oil, production azo-compounds, tar, paraffin etc.), effect of ionizing radiation (X-ray, gamma-radiation, etc.), arsenic	All work related to the effect of substances listed in column 3, in various industries. Work with radioactive substances, other types of ionizing radiation, work associated with arsenic
2)	mouth cavity and respiratory organs tumors (МКБ 10: C04-C06, C30.0-C34.9, C38.4, C39)	Nickel, chrome, arsenic, coal tar; asbestos, asphalt compounds, inhalation of radioactive ores and dust with hydrocarbons adsorbed on them, carbon fiber, cadmium and its compounds	Works associated with the production of nickel, arsenic, chromium compounds; exploration, extraction and processing of radioactive ores, asbestos and asbestos-containing materials; rubber production, cadmium production; Works associated with production of artificial garnet and products made of it, asphalt, furniture and woodworking industry.
3)	liver tumors (МКБ 10:	Vinyl chloride,	Work with vinyl

	C22)	long-term contact with radioactive substances tropic to the hepatic tissue (polonium, thorium, plutonium), beryllium and its compounds	chloride, beryllium and its compounds, work in radio-chemical industries.
4)	tumors of the stomach (МКБ 10: C16)	Hexavalent chromium compounds, asbestos-containing dust, nickel, hydrocarbons adsorbed on dust, benzopyrene, soot	Work on production of chrome compounds, asbestos and asbestos containing products, the production of nickel, contact with dust with hydrocarbons adsorbed on it, rubber-technical production.
5)	leukemia (МКБ 10: C91-C95)	Benzene, the effects of various types of ionizing radiation	Work with benzene and sources of ionizing radiation.
6)	bladder tumors (papilloma, cancer) (МКБ 10: C67)	Amines of benzene and naphthalic series (benzidine, dianisidine, naphthylamine)	Work with these substances in various industries.
7)	bone tumors (МКБ 10: C40-C41)	Long-term contact with osteotropic radioactive substances (radium, strontium, plutonium)	Work in radiochemical production, radiological and radio-chemical laboratories.
8)	kidney tumors (МКБ 10: C64)	Cadmium and its compounds	Work with cadmium and its compounds

Appendix 2  
to the Rules of investigation of  
cases of infectious and parasitic,  
occupational diseases and  
intoxication of population  
Form

**Report on chronic occupational disease (intoxication)**

1. Full name \_\_\_\_\_
2. \_\_\_\_\_
- Sex \_\_\_\_\_
3. \_\_\_\_\_
- Age \_\_\_\_\_  
(completed years)
4. Name of organization, its form of ownership  
\_\_\_\_\_
5. Name of shop, department, section  
\_\_\_\_\_
6. Total work experience \_\_\_\_\_
7. Work experience. In contact with harmful production factors resulted in occupational disease) \_\_\_\_\_
8. Main diagnosis \_\_\_\_\_  
(Secondary) \_\_\_\_\_
9. Harmful production factor resulted in a disease \_\_\_\_\_
10. Date of the final diagnosis  
\_\_\_\_\_
11. Name of organization which determined a diagnosis  
\_\_\_\_\_
12. Report's registration No. \_\_\_)  
\_\_\_\_\_ 20 \_\_\_\_
- Date of report sending \_\_\_\_\_
- Place of seal \_\_\_\_\_ 20 \_\_\_\_
- Signature of the person who sent the report  
\_\_\_\_\_  
(full name)

Appendix 3  
to the Rules of investigation of  
cases of infectious and parasitic,  
occupational diseases and  
intoxication of population  
Form

**Conclusion of the expert occupational pathology commission**

Minutes No. \_\_\_\_\_ dated \_\_\_\_\_ 20 \_\_\_\_

1. Patient's full name \_\_\_\_\_
2. Date of birth \_\_\_\_\_
3. Home address \_\_\_\_\_
4. Place of work and occupation \_\_\_\_\_
5. Dates:  
appointment to hospital \_\_\_\_\_
- 6) at hospital: admission \_\_\_\_\_  
leave \_\_\_\_\_
6. Main occupation \_\_\_\_\_
7. Occupational history. Sanitary and epidemiological features for primary patients  
No. \_\_\_\_\_  
dd. \_\_\_\_\_
8. Patient's life history \_\_\_\_\_
9. History of present illness \_\_\_\_\_
10. Patient's complaints \_\_\_\_\_
11. Objective evidence \_\_\_\_\_

Examination

\_\_\_\_\_ X-ray examination

12. Consultations \_\_\_\_\_
13. Treatment \_\_\_\_\_
14. Post treatment status \_\_\_\_\_

**Social and clinical report**

Main diagnosis  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_



Secondary diagnosis

\_\_\_\_\_  
 \_\_\_\_\_

Recommendations to work \_\_\_\_\_

\_\_\_\_\_

Recommendations \_\_\_\_\_

Time of the repeated examination \_\_\_\_\_

Commission Chairman \_\_\_\_\_

Commission Members \_\_\_\_\_

Appendix 4  
 to the Rules of investigation of  
 cases of infectious and parasitic,  
 occupational diseases and  
 intoxication of population  
 Form

**Record book  
 of registration of persons who were diagnosed  
 an occupational disease, intoxication**

Starts on \_\_\_\_\_ year of 20 \_\_\_\_\_

Finished on \_\_\_\_\_ year of 20 \_\_\_\_\_

Registrati on No.	Full nam e	Se x	Ag e	Compan y name	Shop, divisio n, section	Occupati on	Work experience	
							Total work experien ce	I contacted with harmful occupational factors resulted in occupational disease
1	2	3	4	5	6	7	8	9

Table (continuation)

Harmful occupational factors	Diagnosis	Name of organization which established a final diagnosis	Note
10	11	12	13

*Appendix No. 3*

**On approval of the rules of registration, keeping records of cases of infectious and parasitic, occupational diseases and intoxication, and the rules of recording them**

Decree of the Minister of National Economy of the Republic of Kazakhstan No. 451 dated June 24, 2015. It is registered at the Ministry of Justice of the Republic of Kazakhstan under No. 12083 dated September 19, 2015.

In accordance with item 1 of article 151 of the Code of the Republic of Kazakhstan dated September 18, 2009 “On People’s Health and Healthcare System”, **it is hereby ORDERED:**

1. To approve:

- 1) The Rules of registration, keeping records of cases of infectious, parasitic, occupational diseases and intoxications according to the Appendix No. 1 to this Decree;
- 2) The Rules on recording of infectious, parasitic, occupational diseases and intoxications according to the Appendix No. 2 to this Decree.

2. The Committee for the Protection of Consumer Rights of the Ministry of National Economy of the Republic of Kazakhstan according to the procedure provided for by the legislation shall ensure:

- 1) state registration of this decree at the Ministry of Justice of the Republic of Kazakhstan;
- 2) within ten calendar days after the state registration of this decree its transfer to printed periodicals and in Adilet – information and legal system for official publication;
- 3) putting of this decree on the official internet-resource of the Ministry of National Economy of the Republic of Kazakhstan.

3. The decree of the Minister of Health of the Republic of Kazakhstan as of November 12, 2009 No. 706 “On some issues of registration of infectious, parasitic, occupational diseases and intoxications” (recorded in the State Register of regulatory legal acts No. 5908 being published in the Corpus of acts of the central executive agencies and other central governmental authorities of the Republic of Kazakhstan No.3, 2010), shall be declared to be no longer in force.

4. The execution of this decree shall be charged on the supervising vice-minister of the national Economy of the Republic of Kazakhstan.

5. This decree shall come into force on the expiry of ten calendar days from the date of its first official publication.

*Minister of National Economy  
of the Republic of Kazakhstan*

*Ye.*

*Dossayev*

“AGREED”  
Minister of Justice  
of the Republic of Kazakhstan  
\_\_\_\_\_ B. Imashev

August 14, 2015

“AGREED”  
Minister of Health  
of the Republic of Kazakhstan  
\_\_\_\_\_ T. Dyuisenov

June 24, 2015

## **The rules of registration, keeping records of cases of infectious and parasitic, occupational diseases and intoxications**

### **1. General provisions**

1. These Rules of registration, keeping records of cases of infectious, parasitic, occupational diseases and intoxications (hereinafter – Rules) have been developed in accordance with the Code of the Republic of Kazakhstan “On People’s Health and Healthcare System” dated September 18, 2009, and define the procedure of registration, keeping records of cases of infectious, parasitic, occupational diseases and intoxications.

### **2. Registration and keeping records of cases of infectious and parasitic diseases**

2. The registration and keeping records of cases of infectious and parasitic diseases among the population shall be conducted at the place of a disease diagnosing regardless of the place of permanent residence of a patient.

3. Individually recorded at medical institutions and in local subdivisions of the state body administration in the sphere of sanitary and epidemiological welfare of population shall be the infectious and parasitic diseases according to the list of infectious and parasitic diseases among population subject to registration and recording as per the Annex to these Rules.

On each case of a disease subject to individual record it is made an expedited report as per a form No. 058/y approved by the decree of the Acting Minister of Health of the Republic of Kazakhstan No. 907 dated November 23, 2010 “On approval of forms of primary medical documentation of healthcare organizations” recorded in the State Register of regulatory legal acts No. 6697 (hereinafter – Decree No. 907) which within 12 hours shall be sent to a local subdivision of the state body administration in the sphere of sanitary and epidemiological welfare of population at the place of a disease recording (regardless of the place of permanent residence of a patient). Within 3 hours the information shall be delivered by phone.

4. The registration and keeping records of cases of a plague, cholera, yellow fever, dengue-fever, West Nile Fever, Crimean-Congo hemorrhagic fever, spotted fever, Ebola fever, schistosomiasis, tuberculosis and a disease affected by human immunodeficiency virus (hereinafter – AIDS) shall be performed as follows:

1) if a person affected by a plague, cholera, yellow fever, dengue-fever, West Nile Fever, Crimean-Congo hemorrhagic fever, spotted fever, Ebola fever, schistosomiasis or suspected to it a health worker who detected a patient shall to each case make an expedited report as per a form No. 058/y approved by the decree No. 907 (hereinafter - expedited report No. 058/y) which within 3 hours is sent to a local subdivision of the state body administration in the sphere of sanitary and epidemiological welfare of population. Also, extraordinary information shall be sent to the local agency of the state healthcare administration;

2) for every patient who is first time diagnosed an active tuberculosis of all forms of distribution a report as per a form No. 089/y approved by the decree No. 907 (hereinafter – report No. 089/y) is filled in, which within 3 calendar days shall be sent to the district (municipal) antituberculosis dispensary (department, office) and local subdivision of the state body administration in the sphere of sanitary and epidemiological welfare of population.

When detecting patients with bacillary form of tuberculosis at elimination of bacilli in patients with healed tuberculosis as well as in cases of death of patients by tuberculosis who have been not registered while alive, an expedited report No. 058/y shall be filled in which within 24 hours is sent to a local subdivision of the state body administration in the sphere of sanitary and epidemiological welfare of population at the place of residence of a patient.

The district (municipal) antituberculosis dispensary (department, office) shall monthly on the second day of a month following the reporting period send to a local subdivision of the state body administration in the sphere of sanitary and epidemiological welfare of population for reconciliation the summary data on the number of newly discovered patients with active tuberculosis based on the received expedited reports No. 058/y and reports No. 089/y;

3) recording and registration of cases of asymptomatic infectious status affected by a human immunodeficiency virus (hereinafter – HIV infection) and persons affected by AIDS shall be conducted by healthcare organizations carrying out activities in the sphere of HIV/AIDS prophylaxis (hereinafter – AIDS centers).

The regional, municipal AIDS centers (the cities of Astana and Almaty) monthly on the second day of the month following the reporting period shall inform the local subdivision of the state body administration in the sphere of sanitary and epidemiological welfare of population on the summary data on the number of newly discovered cases of HIV infection and persons affected by AIDS.

5. Diseases subject to be individually recorded at medical institutions and summary recorded at local subdivisions of the state body administration in the sphere of sanitary and epidemiological welfare of population is: flue, acute infections of upper air passages of multiple or unspecified site, and functional diarrhea.

The expedited report No. 058/y to the cases of flue, acute infections of upper air passages of multiple or unspecified site, and functional diarrhea is not represented, they are recorded in outpatient organizations. The outpatient organizations monthly on the second day of the month following the reporting period shall send the summary data on a number of patients to the local subdivisions of the state body administration in the sphere of sanitary and epidemiological welfare of population.

6. The expedited report No. 058/y is filled in by a health worker who diagnosed or suspected a disease in the following medical organizations regardless of the forms of ownership and departmental subordination:

1) outpatient organizations regardless of the conditions at which a disease has been discovered (if a patient goes to outpatient clinic, a patient was visited by a doctor at home, a patient was preventively examined, and others);

2) at in-patient departments in cases when an infectious disease has been diagnosed at in-patient department (a patient presents without an appointment of an outpatient organization, the diagnosis of an infectious disease has been made instead of the diagnosis of another disease, a hospital-acquired infection case, and a disease detected at sport class);

3) in forensic medical examination organization;

4) at medical rooms of organizations regardless of the form of ownership;

5) at organizations of the primary medical care.

7. Health workers of a feldsher-midwife station the expedited report No. 058/y shall make in two copies: first copy shall be sent to a local subdivision of the state body administration in the sphere of sanitary and epidemiological welfare of population, and the second one - to the medical organization under the supervision of this feldsher-midwife station (medical

district, district, municipal hospital, ambulatory, outpatient department and other).

8. Recording of diseases among the children attending educational organizations shall be carried out as follows:

1) medical staff providing services to educational organizations sends an expedited report No. 058/y to a local subdivision of the state body administration in the sphere of sanitary and epidemiological welfare of population only in those cases when an infectious disease (suspected) has been first time detected by the staff of those organizations;

2) when detecting an infectious disease (suspected) by a medical staff of medical organizations in children attending educational organizations an expedited report No. 058/y shall be sent to local subdivision of the state body administration in the sphere of sanitary and epidemiological welfare of population by the staff of those organizations;

3) medical staff providing services to healthful organizations for children which left to country for summer the expedited report No. 058/y shall be sent to local subdivision of the state body administration in the sphere of sanitary and epidemiological welfare of population at the place of temporary location of a healthful organization in summer.

9. Health workers of Emergency medical services who diagnosed or suspected an infectious disease shall inform about the detected patient to the outpatient clinic (ambulatory) of the district under service where the patient resides. In cases when a patient is not admitted to hospital the expedited report No. 058/y to local subdivision of the state body administration in the sphere of sanitary and epidemiological welfare of population shall be sent by a health worker of the outpatient clinic who visits the patient at home, and in case of admission of patient the report shall be sent by the health worker of the in-patient department.

10. Representation of information on admission of patients with infectious diseases (suspected infectious diseases) to hospital treatment, on infectious disease specification or change shall be performed as follows:

1) the infectious diseases hospital (a hospital with infectious disease ward) shall inform on admission of an infectious disease patient (suspected) within 12 hours from the moment of admission of the patient to local subdivision of the state body administration in the sphere of sanitary and epidemiological welfare of population in the region where the medical organization that appointed the patient for hospitalization, is located;

2) the medical organization which specified or changed the diagnosis shall make a new expedited report No. 058/y and within 12 hours send it to local subdivision of the state body administration in the sphere of sanitary

and epidemiological welfare of population at the place of detection of a disease indicating the specified (changed) diagnosis, date of establishment, initial diagnosis and the laboratory results.

11. In all medical organizations, medical rooms of organizations regardless of the forms of ownership the Record book of infectious diseases according to form No. 060/y approved by the decree No. 907 shall be kept containing the data about the patient.

12. For registration, recording of infectious and parasitic diseases in medical organizations the following persons shall be responsible:

- 1) in medical organizations – head physician;
- 2) in educational organizations, healthy organizations – a healthy worker of that organization.

13. Keeping records of infectious and parasitic diseases in local subdivision of the state body administration in the sphere of sanitary and epidemiological welfare of population based on the operational message on detection of the infectious disease (suspected) and further confirmed by the expedited report No. 058/y.

14. The local subdivision of the state body administration in the sphere of sanitary and epidemiological welfare of population at detection on its area of the case of infectious disease in persons who came from another regions shall inform the local subdivision of the state body administration in the sphere of sanitary and epidemiological welfare of population at the place of constant residence of the sick persons for the conduction of appropriate sanitary arrangements and sanitary and epidemiology arrangements in the hotbed of a disease.

### **3. Registration and keeping records of cases of occupational diseases and intoxications.**

15. Subject to registration and keeping records at local subdivision of the state body administration in the sphere of sanitary and epidemiological welfare of population are the acute chronic occupational diseases and intoxications based on the expedited reports No. 058/y.

16. On each case of the acute chronic occupational diseases and intoxication the doctor who detected or suspected such a disease shall fill in the expedited report No. 058/y which within 12 hours is transferred to the local subdivision of the state body administration in the sphere of sanitary and epidemiological welfare of population and to the head of the organization (employer) at the place of work of the sick (injured) person.

17. healthy organization when specifying or changing of a diagnosis shall compose a new expedited report No. 058/y which within 24 hours shall be transferred to the local subdivision of the state body administration in the

sphere of sanitary and epidemiological welfare of population and to the head of the organization (employer) at the place of work of the sick (injured) person upon that a changed (specified) diagnosis, the date of its establishment, and an initial diagnosis is indicated.

18. The responsibility for the in-time representation of the expedited report No. 058/y in case of the acute or chronic occupational disease, on the change or annulment of the diagnosis shall bear the head of healthy organization which established (cancelled) the diagnosis.

19. The expedited report No. 058/y about the first time detected chronic occupational disease (intoxication) shall be filled in at the centers of occupational pathology and in clinics of occupational diseases. The expedited report No. 058/y within 3 calendar days after the establishment of the final diagnosis shall be sent to the local subdivision of the state body administration in the sphere of sanitary and epidemiological welfare of population and to the head of the organization (employer) at the place of work of the sick (injured) person, as well as to the healthy organization which referred the sick (injured) person. The expedited report No. 058/y on the first time detected chronic occupational disease (intoxication) shall be sent to the last work place of the sick person in contact with harmful production factors.

20. Registration and keeping records of cases of occupational diseases and intoxications shall be kept in local subdivisions of the state body administration in the sphere of sanitary and epidemiological welfare of population at the main work place of the sick (injured) person in contact with harmful production factors.

21. In local subdivisions of the state body administration in the sphere of sanitary and epidemiological welfare of population the Records of occupational disease (intoxication) in the form approved by the Decree of the Minister of National economy of the Republic of Kazakhstan No. 415 dated May 30, 2015 “On approval of the form of record and report documentation in the sphere of sanitary and epidemiological welfare of population” registered in the State Register of regulatory legal acts No. 11626 (hereinafter – Decree No. 415).

22. In local subdivisions of the state body administration in the sphere of sanitary and epidemiological welfare of population, healthy organizations, and centers of occupational pathology the Record book of occupational diseases (intoxications) is kept according to the form approved by the Decree No. 415.

Appendix  
To Rules of registration,  
keeping records of cases  
of infectious, parasitic,  
occupational diseases and intoxications

**The list of infectious and parasitic diseases among the population  
subject to registration and keeping record in the Republic of  
Kazakhstan**

- 1) cholera (A00);
- 2) typhoid fever (A01.0);
- 3) paratyphoid fever A, B, C (A01.1-A01.4);
- 4) other salmonella infections (A02);
- 5) shigellosis (bacillary dysentery) (A03);
- 6) other bacterial intestinal infections (A04.0-A04.5; A04.7-A04.9);
- 7) enteritis due to *Yersinia enterocolitica* (yersiniosis) (A04.6; A28.2);
- 8) other bacterial foodborne intoxications (A05);
- 9) rotaviral enteritis (A08.0);
- 10) viral and other specified enteroviruses (A08);
- 11) tuberculosis (A15-A19);
- 12) plague (A20);
- 13) tularemia (A21);
- 14) splenic fever (A22);
- 15) brucellosis (A23);
- 16) Charente fever (A27);
- 17) hemorrhagic septicemia (A.28.0);
- 18) circling disease (A.32);
- 19) tetanus (A.33-A35);
- 20) diphtheria (A36);
- 21) pertussis (A37);
- 22) scarlatina (A38);
- 23) Meningococcal disease (A39);
- 24) legionnaires disease (A48.1);
- 25) syphilis (A50-A53);
- 26) gonococcal infection (A54);
- 27) Chlamydial infection (A55; A56);
- 28) Lyme disease (A69.2)
- 29) parrot disease, ornithosis (A70);
- 30) rickettsioses (A75-A79);

- 31) acute poliomyelitis (A80);
- 32) lyssa (A82);
- 33) tick-borne viral encephalitis (A84);
- 34) arthropod-borne viral fevers and viral hemorrhagic fevers (A90-A99);
- 35) yellow fever (A95);
- 36) chickenpox (B01);
- 37) measles (B05);
- 38) rubella (B06);
- 39) epizootic aphthae (B08.8);
- 40) viral hepatitis (B15-B19);
- 41) disease due to human immune deficiency virus (B20-B24);
- 42) parotitis (B26);
- 43) vernal fever (B50-B54);
- 44) leishmaniasis (B55);
- 45) helminthiasis (B65-B83);
- 46) pediculosis (B85);
- 47) scabies (B86);
- 48) acute infections of upper air passages of multiple or unspecified site (J06);
- 49) influenza (J10-J11);
- 50) functional diarrhea (K59.1; K59.9);
- 51) complications preferentially due to postpartum period (O85; O86; O90.0; O90.1; O91);
- 52) infectious diseases specific for perinatal life (P36-P39);
- 53) complications from surgical and therapeutic interventions (T80.2; T80.8; T80.9; T81.3; T81.4; T82.6; T82.7; T83.5; T83.6; T84.5-T84.7; T.85.7);
- 54) uncommon reactions to prophylactic immunization, post vaccination complications (T88.7);
- 55) animal bites, beslobber, scratch (W54; W55);
- 56) asymptomatic infectious state caused by human immunodeficiency virus (HIV) (Z21);
- 57) typhoid fever activator carrier (Z22.0);
- 58) salmonellosis activator carrier (Z22.1);
- 59) dysentery activator carrier (Z22.1);
- 60) diphtheria activator carrier (Z22.2);
- 61) malaria activator carrier (Z22.8).

Appendix 2  
to the Decree of the Minister of

**The rules of registration, keeping records of cases of infectious,  
parasitic, occupational diseases and intoxications**

1. These Rules of registration, keeping records of cases of infectious, parasitic, occupational diseases and intoxications (hereinafter – Rules) have been developed in accordance with the Code of the Republic of Kazakhstan “On People’s Health and Healthcare System” dated September 18, 2009, and define the procedure of keeping records of cases of infectious, parasitic, occupational diseases and intoxications among the population of the Republic of Kazakhstan.

2. The report on infectious and parasitic diseases among the population of the Republic of Kazakhstan is represented according to the form approved by the Decree of the Minister of National Economy of the Republic of Kazakhstan No.415 dated May 30, 2015 “On approval of the form of record and report documentation in the sphere of sanitary and epidemiological welfare of population” registered in the State Register of regulatory legal acts No. 11626 (hereinafter – report on infectious and parasitic diseases) as follows:

1) district local subdivisions of the state body administration in the sphere of sanitary and epidemiological welfare of population shall on a monthly basis on the 3<sup>rd</sup> day of each month following the reporting period represent the report on infectious and parasitic diseases to the regional local subdivision of the state body administration in the sphere of sanitary and epidemiological welfare of population;

2) organizations of sanitary and epidemiological service of other ministries and administrations shall on a monthly basis on the 3<sup>rd</sup> day of each month following the reporting period represent the report on infectious and parasitic diseases to the regional local subdivision of the state body administration in the sphere of sanitary and epidemiological welfare of population;

3) regional local subdivisions of the state body administration in the sphere of sanitary and epidemiological welfare of population shall on a monthly basis on the 5<sup>th</sup> day of each month following the reporting period represent the report on infectious and parasitic diseases to the Republican state enterprise “Research and practical center on sanitary-epidemiological expertise and control” of the Committee for consumer rights protection of

the Ministry of National Economy of the Republic of Kazakhstan (hereinafter – RPCSEEC) and the regional authority of the state administration for health;

4) RPCSEEC shall on a monthly basis on the 8<sup>th</sup> day of month following the reporting period represent the report on infectious and parasitic diseases to the subdivision of the state body administration in the sphere of sanitary and epidemiological welfare of population.

3. The report on occupational diseases and intoxications among the population shall be represented as follows:

1) centers of occupational pathology and clinics of occupational diseases shall on a monthly basis on the 10<sup>th</sup> day of a month following the reporting period represent the report to the regional local subdivision of the state body administration in the sphere of sanitary and epidemiological welfare of population indicating the list of the sick who has been first time diagnosed an occupational disease or intoxication. The report shall contain the surname, name and patronymic (if any) of the sick (injured) person, year of birth, place of birth, diagnosis, and the date of diagnosis;

2) the regional local subdivisions of the state body administration in the sphere of sanitary and epidemiological welfare of population shall on a monthly basis on the 12<sup>th</sup> day of a month following the reporting period represent the report on occupational disease or intoxication to the RPCSEEC;

3) the RPCSEEC shall on a monthly basis on the 15<sup>th</sup> day of a month following the reporting period represent the summary report on occupational diseases or intoxications to the state body administration in the sphere of sanitary and epidemiological welfare of population.

In their activity the specialists in the sphere of occupational health, occupational health and safety, occupational pathology, specialists of public health must govern the following regulatory legal acts:

1. Resolution of the Government of the Republic of Kazakhstan No. 2015 “On approval of the list of medical psychiatric counterindications for carrying out of separate types of professional activities as well as of works connected to the source of increased danger” dated December 4, 2009.

2. Resolution of the Government of the Republic of Kazakhstan No. 652 “On approval of the Rules on referring of the types of economic activity to the occupational risk classes” dated June 30, 2005.

3. Decree of the Ministry of Health and Social Development of the Republic of Kazakhstan No. 454 “On approval of the plan of measures on early detection of risk groups and prevention of occupational diseases” dated June 4, 2015.