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Modernization of the Curricula in sphere of smart building engineering - Green Building (GREB)

ҲАЁТ ФАОЛИЯТИ ХАВФСИЗЛИГИ ВА МЕҲНАТ ГИГИЕНАСИНИНГ ҚУРИЛИШДАГИ ЎРНИ

Course title in national language

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ВОПРОСИ БЕЗОПАСНОСТИ И ГИГИЕНЫ ТРУДА В СТРОИТЕЛЬСТВЕ

Course title in English language

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OCCUPATIONAL SAFETY AND HEALTH ISSUES IN BUILDINGS

Course title in Russian language

Tashkent - 2018

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The purpose of life safety is to provide comfortable conditions for human activities at all stages of its life cycle and the normatively permissible levels of negative factors affecting humans and the natural environment.
The tasks of life safety are reduced to theoretical analysis and development of identification methods (recognition and quantification) of hazardous and harmful factors generated by environmental Themes (technical means, technological processes, materials, buildings and structures, technosphere Themes, natural phenomena).

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Tashkent 2018

1: Management of Health and Safety

Theme of the lecture	Clock
Theme 1: The subject of lifetime and labor hygiene. goal and tasks. basic concepts and definitions. 1.1. Goals and objectives of occupational health and safety. 1.2. Object of study 1.3. Basic concepts and definitions **Theme 2: Theoretical foundations of occupational safety and health issues** 2.1. Basic principles of the theory of risk. 2.2. System security analysis. 2.3. Principles, methods and means of ensuring the safety of work and labor hygiene. 2.4. Psychology of work **Theme 3: Legal, organizational and theoretical foundations of life safety and labor hygiene** 3.1. Scope of the law on occupational health and state policy. 3.2. Providing occupational health. 3.3. Control authorities in the world of work. 3.4. Harm to health of employees in production and the responsibility of the employer. General rules.	10

3.5. The concepts of injury, accidents and occupational diseases. **Theme 4: Production sanitation and hygiene of labor** 4.1. Description of the electromagnetic field. 4.2. The effect of variable electromagnetic fields on the human body. 4.3. Norms of the electromagnetic field. Methods of protection. 4.4. Protection against laser beams. 1.5. Protection from radioactive rays. **Theme 5: Action of electric current on the organism. electrical safety** 5.1. The effect of electric current on the body. 5.2. Electrical resistance of the body. 5.3. The main causes of injury from electric current. 5.4. Protective equipment used in electrical installations. 5.5. Analysis of electrical safety conditions. Step voltage.	
2: Controlling Workplace Hazards	20

Theme 6: Basics of safety technology in the sphere of information technologies 6.1. The concept of safety. 6.2. Fundamentals of security technology in the field of information technology. 6.3. Organization of a safety service. 6.4. Safety when working with optical devices. 6.5. Safety when working with power tools. **Theme 7: Basics of safety technology in the sphere of information technologies.** Information is the result and reflection in the human consciousness, the diversity of the inner and outer worlds (information about the objects, phenomena surrounding the person, actions of other people). **Theme 8: Sanitary and ergonomic requirements to the workplace.** Ergonomics - a science that comprehensively studies a person in the specific conditions of his activity in modern production. The object of ergonomics is man-machine. **Theme 9: Instructions and training of employees to safe work methods** The system of safety training is presented	

below. It includes three main components: the actual training in safe methods and methods of work, organizational and technical and scientific-methodological support. **Theme 10: Fire safety.** Combustion is a chemical reaction of oxidation, accompanied by the release of a large amount of heat and glow. Oxygen is most often the oxidant, and sometimes other chemical elements: chlorine, fluorine, etc. **Theme 11: Technical means of fire fighting and their tasks.** Special machines are intended for performing special works in fire extinguishing: fire ladders and crank lifts, fire trucks, automotive communications and lighting, fire fighting vehicles of technical, gas and water protection and water protection services, as well as staff and operational vehicles equipped with a siren signal and light signal. **Theme 12: Safety and emergency situations.** The State System of Protection of the Population and Territory (SSES) for Emergency Situations The phrase "emergency situation" is used in everyday speech and in special literature. **Theme 13: Natural disasters, their characteristics.**	

Extraordinary situations of a natural nature threaten the inhabitants of our planet since the beginning of civilization. **Theme 14: Protection measures and procedure of action when preventing a natural character** In case of warning about the threat of an earthquake or the appearance of its signs, it is necessary to act quickly, but calmly, confidently and without panic. **Theme 15: First medical aid at bleeding, closed damage, fractures, walls, recovery, solar thermal impact, burns, bloods, poisoning.** When bleeding There are arterial, venous and capillary bleeding. Blood from the gaping wound pours out light red color rhythmically, pulsating jet with arterial bleeding, and dark color continuous continuous stream - with venous.	
Unit 3: Health and safety practical application. **Health and safety practical application** • Demonstrate the ability to apply knowledge of the unit 1 and 2 syllabus, by successful completion of a health and safety inspection of a workplace. • Complete a report to management	4

regarding the inspection with recommendations.	

Themes of laboratory works:

Themes of laboratory works	Clock
• Study of workplace illumination.	2
• Investigation of sound insulation in sound absorption designs.	4
• Investigation of protection against electromagnetic radiation.	4
• Measurement of the electrical resistance of the human body.	4
• Investigation of the safety condition in the zone of electric current propagation.	4
• Study of electrical safety in three-phase alternating current networks up to a voltage of 1000 V.	4
• Insulation status check.	2
• Fire extinguishers and their application.	2
• The study of first aid, damaged from electric current to medical care.	4

Load

Kind of activity	Clock
Lectures	30
Laboratory exercises	30
Independent work	30

TOTAL	**90**

Learning strategy

The course is structured as follows: theoretical classes and classes to solve problem problems, tests and periodic evaluation (assessment), as well as laboratory exercises.

Individual training.

In the course of theoretical studies, the teacher teaches students the necessary concepts, based on the subject. In problem classes, the teacher illustrates an illustration of some problem, while students learn to identify the Themes that are important for solving it. Such lessons are important approach of participation, the importance of communication between the teacher and the trainee.

Auditing work.

During the course of the student, a number of difficulties arise in determining the solution of problems in the concepts under study. For each section, four blocks of questions are given.

Educational materials

The student should be able to obtain in this document the following training materials:

• In the training manual (in this document) there are data on the requirements for students, learning conditions and knowledge assessment.

• Slides presentations on each topic of the course.

• problems for each lesson.

Laboratory work is as follows:

• Goals.

• Materials.

• Tasks.

Assessment

Assessment of students' knowledge includes the assessment of attending classes throughout the course, as well as the results of final control over theoretical and practical lessons. The percentage estimate is as follows:

• Practical classes: 20%

• Final test: 30%

• Laboratory: 50%

Score by theory:

There are two classes for assessing students' knowledge. Examination on the theory is conducted by the teacher, who assigns a place, time and date. The exam assesses the knowledge, skills and skills of students, their ability to solve problematic issues. The assessment of the exam is 30% of the final assessment of the course.

Evaluation of laboratory work:

Assessment for laboratory work in the aggregate for each class and the final exam for laboratory work. This exam is conducted as a laboratory work, the evaluation of which is 50% of the assessment for laboratory (of which 30% for training, 70% for performance).

Evaluation terms:

For each homework sets a certain period. In case of late delivery of the homework assignment, the assessment is reduced.

II. MATERIAL THEORETICAL ACTIVITIES

THEME 1.
THE SUBJECT OF LIFETIME AND LABOR HYGIENE. GOAL AND TASKS. BASIC CONCEPTS AND DEFINITIONS.

Plan:

1. Goals and objectives of occupational health and safety.

2. Object of study

3. Basic concepts and definitions

Goals and objectives

Vital safety and occupational health (BH and GT and GT) is a field of knowledge in which hazards threatening a person (nature), patterns of their manifestation and ways to protect them are studied. In the definition, three things are essential: danger, man (nature), protection. Any activity is potentially dangerous. From this position it follows that there is always some risk, and that the risk can not be zero. Danger - phenomena, processes, objects, capable in certain circumstances to cause damage to human health directly or indirectly, i. E. cause undesirable consequences.

. Danger is stored by all systems that have energy, as well as characteristics that do not correspond to the conditions of human life. Security is a state of activity in which the damage to human health is excluded with a certain probability. Security is the goal. Safety of life is a means of achieving security. By the nature of adverse effects on the human body, the factors that act are called harmful and dangerous. To the harmful include such factors that become in certain conditions the causes of disease or decline in efficiency.

Dangerous factors are called those that lead under certain conditions to traumatic injuries (violation of the tissues of the body and violation of its functions) or other sudden and severe health disorders. The goal of the Belarusian Railways and GT and GT is to provide comfortable conditions for human activity at all stages of its life cycle and the normatively permissible levels of negative factors affecting man and the natural environment.

The tasks of the Belarusian Railways and GT and GT are reduced to theoretical analysis and development of identification methods (recognition and quantification) of hazardous and harmful factors generated by environmental elements (technical means, technological processes, materials, buildings and structures, technosphere elements, natural phenomena). The range of scientific tasks also includes: a comprehensive assessment of the multifactorial impact of negative habitat conditions on health and human performance; optimization of working and rest conditions; implementation of new methods of protection; etc. The range of practical tasks is primarily determined by the choice of the principles of protection, the development and rational use of human and natural environment (biosphere) protection against the negative impact of man-made sources and natural phenomena, as well as the means ensuring a comfortable state of life.

The object of studying the Belarusian Railway and GT

The object of studying the Belarusian Railways and GT as a science is the environment or conditions of human habitation. This environment of genesis (origin) can be classified into production and non-production. The main element of the production environment is labor, which in turn consists of interrelated and interacting elements (Fig. 1), which make up the structure of labor:

C - subjects of labor, M - "machines" - means and objects of labor, FT - labor processes, consisting of acting both subjects and machines, RTP - products of labor both targeted and by-products in the form of harmful and dangerous impurities formed to the air environment, etc., PO - production relations (organizational, economic, socio-psychological, legal labor: relations related to the culture of work, professional culture, aesthetic, etc.).

The natural environment in the form of geographic-landscape (G-L), geophysical (D), climatic (K) elements; Natural disasters (SB), including fires from lightning and other natural sources; natural processes (PP) in the form of gas emissions from rocks and the like. can manifest itself both in the non-productive sphere and in the production sphere, especially in such branches of the national economy as construction, mining, geology, geodesy, and others. The general culture is composed of such elements as moral culture (NK), general education (OK), legal (PC), culture of communication (KO).

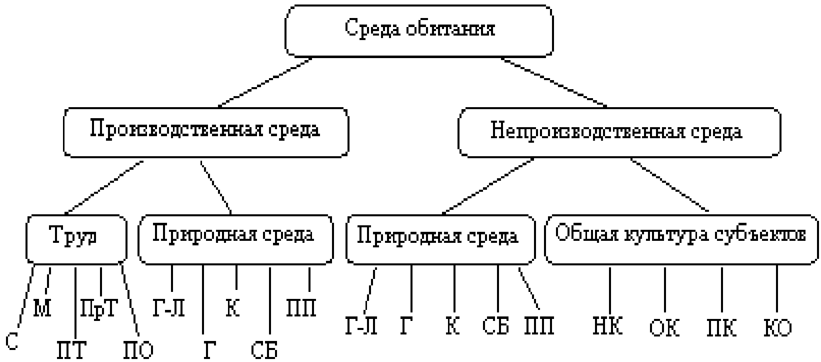


Fig.1. Elements of the human environment

All the elements that make up the human habitat in action become factors that affect the Belarusian Railways and the GT. Therefore, when studying the habitat, BG and GT must consider the influence of these factors on the individual, as well as in the aggregate. Only with such a system approach can the unconventional implementation of the ultimate goal of the Belarusian Railways and GT be implemented in the complex.

Labor, the natural environment, the general culture of the subjects as an element of the human environment in isolation, are the object of study of many natural and social sciences: political economy, philosophy, occupational health, ergonomics, sociology, engineering psychology and others. These sciences differ from each other in the subject of study, purpose and tasks. His subjects of study are both BZhD and GT. These include the physiological and psychophysiological capabilities of a person from the point of view of the Belarusian Railway and the GT, the formation of safe conditions and their optimization, etc.

Basic concepts, terms, definitions In any scientific and educational discipline, the terminological apparatus is of great importance. Belarusian Railways and GT operates a number of such concepts. Define the main ones. Life safety is a field of knowledge in which hazards that threaten a person, the patterns of their manifestation and ways to protect them are studied. There are three important points in the definition: danger, man, protection. Danger is the central concept of the Belarusian Railways and the GT, which refers to phenomena and processes that, under certain conditions, can damage the health of a person directly or indirectly.

Danger - this is a consequence of the impact on human rights of some factors. If these factors do not correspond to the characteristics of a human being as a biological object, a danger phenomenon arises. With a detailed decomposition of the active process, two types of unfavorable environmental factors can be identified. A harmful factor is an effect on a person, which under certain conditions leads to a gradual deterioration in the health of the disease or a decrease in working capacity.

A dangerous factor is exposure to a person who, under certain conditions, leads to trauma or other sudden sharp deterioration in health. The above definitions of hazardous and harmful factors are valid for their manifestation in the process of any human activity (in the industrial, domestic and natural environment).

These factors when classified (GOST 12.0.003-74) are not divided into dangerous and harmful. This is to some extent true, since the harmful factor can, in its quantitative increase, go into a dangerous one (for example, noise). It must be emphasized that the harmful factor is always evaluated from a quantitative point of view and can be permanently in effect for some time. The dangerous factor most often is the probabilistic nature of the occurrence (manifestation).

Dangerous and harmful factors of particularly high intensity in an emergency situation (accident, disaster, etc.) are often called striking factors. Factors are characterized by the potential (level), quality, life time or impact on a person, the likelihood of developing the size of the zone of action. The potential determines the quantitative side of the factor (noise level, concentration of harmful substances, voltage of electric current, etc.).

Quality reflects the specific features of the factor that affect the human body (frequency composition of noise, dust dispersion, type of current, etc.). The space in which dangerous or harmful factors are constantly in operation or periodically occur, is usually called a dangerous zone Hazardous areas by spatial characteristics can be local and deployed, and in time - permanent and temporary. Material objects that carry dangerous and harmful factors are called sources of danger. Activity is a form of an active relationship of a person to the world around him. All activities include the goal, the means, the result and the process of activity itself. Security is a state of activity in which the manifestation of danger is excluded with a certain probability. Risk is the quantitative assessment of a hazard, defined as the frequency or likelihood of an adverse event from a security perspective.

THEME -2.
THEORETICAL FOUNDATIONS OF OCCUPATIONAL SAFETY AND HEALTH ISSUES

Plan:

2.1. Basic principles of the theory of risk.

2.2. System security analysis.

2.3. Principles, methods and means of ensuring the safety of work and labor hygiene.

2.4. Psychology of work

Basic phrases: *Risk, safety of activity, taxonomy, nomenclature of risks, safety concept, technological processes, microclimate, air of the labor zone, vibration, ventilation, lighting, hygienic norms.*

Basic concepts and definitions of the subject.

- being the central concept of life safety, it means how much and how accidents, processes and objects can harm directly or indirectly human health, that is, leads to undesirable consequences.

The number of signs characterizing the risk may increase or decrease depending on the purpose of the analysis. The description of risk in the Belarusian Railways and GTs, given above, is a very massive concept, covering the existing standard concepts (hazardous and harmful factors of production), and also taking into account all activities. Risk includes all systems containing energetically active chemical or biological components, as well as characteristics that do not meet human living conditions.

Taxonomy of Dangers Taxonomy is the science of the classification and systematization of complex phenomena, concepts and objects. The word taxonomy means the placement of letters according to the rules. Since danger is a complex concept, hierarchical, with many signs, their taxonomy plays an important role in organizing scientific knowledge in the field of the Belarusian Railways and the GT, allows for a deeper understanding of the nature of the hazard. While there is no full taxonomy of risks. This suggests that in the future teachers and scientists will conduct huge scientific research.

Identification of hazards	Identification of risk - the process of finding, compiling a list and describing the elements of risk.

Nomenclature of hazards	Nomenclature is a list of names and words systematized by certain characteristics. All types of hazards are included in the general nomenclature alphabetically: alcohol, abnormal air temperature, explosion, explosives, vibration, sparks, infrasound, death, vacuum, volcano, panic, gas, herbicide, pain, dynamic fatigue, disintegration, rain, fire , fatigue, earthquake, pollution, disease, lack of burns, trauma, azure rays, magnetic field, thunder,

	meteorites, microorganisms, dampness, pulsation, lowering, radiation, resonance, slip, vibration, wind, fatigue, electric shock, ultrasound, noise, electric field, ice rink , core.
Cause and effect	Conditions that lead to potential (hidden) hazards are the cause. They characterize the totality of circumstances through which dangers manifest themselves and cause certain undesirable events - consequences.

Here are some examples:

- Poison (danger) - error (reason) -off (undesirable consequence).

- Electric current (danger) - short circuit (cause) - burn (undesirable consequence).

- Alcohol (danger) - drinking (reason) - death (undesirable consequence).

Classification of hazards.

1. In areas of origin (where a source of danger arises), all hazards can be classified into the following groups: threats from the natural environment (natural disasters), danger from the technogenic environment (accident), epidemiological hazards (mass diseases), dangers from the social environment.

2. By the nature of the impact on man - mechanical, physical, chemical, biological, psychophysiological.

3. By the time of manifestation of negative consequences - impulse and cumulative.

4. Increased consequences - fatigue, disease, injuries, accidents, crisis situations, accidents, deaths.

5. For the damage caused - technical, economic, environmental, social.

6. Localization - atmospheric, hydrosphere, lithospheric, cosmic.

7. In the sphere of manifestation - household, industrial, sports, road transport, military.

8. By structure - simple and derivative, generated by the interaction of simple.

9. On the realized energy - active and passive (which are manifested at the expense of energy, the carrier of which is the person himself).

There are signs of danger appearing before (a priori) accident and after (a posteriori) accident occurrence. There is an axiom - any activity is potentially dangerous. At the same time, it is considered that the level of danger (risk) can be controlled. This led to the notion of "acceptable risk". At the heart of acceptable risk is the realization of the unattainability of absolute security.

1.2. Basic rules of risk theory In September 1990, in Cologne, the First World Congress on Safety of Activities was held, as a scientific discipline, held under the motto "Life in Security". Specialists from different countries in their reports and reports constantly operated on the notion of "risk." V. Marshall gives the following definition; risk - the frequency of the implementation of hazards.

The most common definition is this; risk is a quantitative assessment of hazards. Quantitative assessment is the ratio of the number of certain adverse effects to their possible number for a certain period. When determining the risk, it is necessary to specify a class of consequences, that is, to answer a question; risk of what? Formally, the risk is the frequency. But in essence, there is a significant difference between these concepts, since, with respect to security problems, a possible number of adverse consequences have to be said with a certain degree of conventionality. Before we study the remaining features of the problems of risk, we give the following 2 examples.

1-example. Determine the risk of deaths per year in production in the CIS, if every year 14,000 people die, and the average number of working people is 138 million:

$$R_{mam}q\frac{1,4\cdot 10^4}{1,38\cdot 10^8}=10^{-4}$$

The anwer is 10^{-4}.

2-example. If every year 500 thousand people die in the country for various dangerous reasons, except for the non-native ones, and the country's population is 300 million people, the risk of death due to hazards is determined as follows:

$$R_{mam\ q}\frac{5\cdot 10^5}{3\cdot 10^8}=1,7\cdot 10^{-3}$$

Individual risk

Individual risk characterizes the danger of a particular species for an individual.

Social risk

Social or - this is a risk for a group of people. Social risk can be defined as the relationship between the frequency of events and the number of people affected.

Public perception of risk, threats and dangers is highly subjective. People, as a rule, react sharply and emotionally to events rare, sensational, accompanied by a large number of victims. At the same time, frequent events, which result in the death of individuals or small groups of people, do not cause such an emotional relationship. Despite the fact that 40-50 people die daily in Uzbekistan, and more than 1000 people per day from various dangers per day, this does not impress the general public in the same way as the death of 5 to 10 people in one accident or some conflict. And people adapt to such losses very quickly.

When, a month after the American tragedy, a Russian plane was shot down by the Ukrainian military in the Black Sea area, this event did not stir public opinion either in Russia or abroad. This should be borne in mind when assessing an acceptable risk. The following table provides information on the characteristics of individual risk. 1-table. Individual risk, which appeared due to various reasons within one year. (from information relating to the entire US population).

Risk quantification. To compare the risks and benefits, many experts propose to introduce a financial measure of human life. This approach raises objections among a certain circle of people who claim that human life is sacred and financial transactions are not permissible. However, in practice, inevitably, there is a need for such an assessment for the sake of human security, if the question is posed: "How much money should be spent to save human life?".

Sociological - examines the attitude of the population to different types of risk, for example, through sociological surveys.

The concept of acceptable risk. The traditional approach to security is based on the concept of "absolute security". Its essence boiled down to the desire to make technology and technosphere absolutely safe for people and assumed the implementation of all protection measures that are practically feasible. However, now people have come to understand that absolute security is unattainable or connected with huge, sometimes unjustified for the society financial costs.

In addition, the requirement of absolute security, bribing with its humanity, turns into a tragedy for people, because it is impossible to ensure zero risk in existing systems, and a person should be oriented toward the possibility of a dangerous situation. Therefore, in the industrialized countries since the late 70's - early 80's. XX century. in security studies, the transition began from the concept of absolute safety to the concept of acceptable (permissible) risk, the essence of which is to reduce the hazard to such a low level that society will accept in a given period of time.

To date, there are ideas about the values of acceptable (permissible) and unacceptable risk. An acceptable risk is the level of danger with which at this stage of society's development you can reconcile. This is such a low level of death, injury or disability people, which does not affect the safety performance of the enterprise, industry or state.

Unacceptable risk is the maximum risk, above which it is necessary to take measures to eliminate it.

Unacceptable risk has a probability of a negative impact of more than 10-3, acceptable - less than 10-6. At risk values from 10-3 to 10-6, it is common to distinguish between the transitional range of risk values. For factors that lead to long-term dangerous consequences and do not have a threshold for action, the same norms are adopted. If such factors affect only when the threshold is exceeded (for example, the maximum permissible concentration of a harmful substance), then the maximum acceptable level of risk corresponds to the threshold. The maximum acceptable risk for ecosystems is one in which 5% of biogeocenosis species can be affected. Acceptable risks are 2-3 orders of magnitude "stricter" than actual ones, i.e. their introduction is directly aimed at protecting a person.

Risk management. Costs for reducing the risk of accidents can be invested in technical safety systems, in training personnel or in improving emergency management. In the first two cases, funds are spent to reduce the probability of an accident, in the third - to reduce its scale, if it happens. Analysis of the effectiveness of investment shows that in many cases it is possible to reduce the risk for the population more strongly if more attention is paid to actions in the event of an accident than to technical prevention systems that still do not give absolute guarantees.

Summarizing all of the above, you can define ways to manage risk:

-improvement of technical security systems;

- training and staff training;

- improvement of emergency management

To properly determine the ratio of investment in each direction, a special analysis is needed using specific data and conditions.

Technical, organizational, administrative methods of risk management are supplemented by economic methods. These include: insurance, monetary compensation for damage, payment for risk, etc. Risk management is based on a methodology for comparing costs and benefits from reducing risk. The combination of qualitative and quantitative analysis at different stages of design and operation results in an assessment of the overall risk.

Hazard identification procedure. The order of hazard identification consists of the following stages.

The first stage is a preliminary hazard analysis. The stage consists of 3 steps.

1-step. Determination of the source of danger.

2-step. Identification of parts of the system that could give rise to a hazard.

3-step. Introduction of restrictions in the analysis, that is, remove hazards that are not required to be studied.

The second stage - Identify the sequence of hazards (dangerous situations). Building a tree of dangerous events.

The third stage is the Analysis of the consequences.

System Security Analysis

System analysis is a set of methodological tools used to prepare and substantiate solutions to complex problems, in this case, security. A system is a set of interconnected components that interact with each other in such a way that a certain result (goal) is achieved. Components (elements, components) of a system are understood not only as material objects, but also relations and connections. Any machine is an example of a technical system. A system, one of whose elements is a person, is called ergatic. Examples of the ergative system: "man-machine," "man-machine-environment," etc. Any object can be represented as a systemic formation.

The principle of systemicism considers phenomena in their mutual connection, as a complete set or complex. The goal or result that the system gives is called a backbone. For example, such a systemic phenomenon as combustion (fire), is possible in the presence of the following components: a combustible substance, an oxidizer, a source of ignition. Except at least one of the named components, we destroy the system.

Systems have qualities that the elements that form them do not have. This important property of systems, called emergence, lies, in essence, at the heart of system analysis in general and security problems, in particular.

The methodological status of system analysis is unusual: elements of theory and practice are intertwined in it, strict formalized methods are combined with intuition and personal experience, with heuristic methods. The purpose of the system safety analysis is to identify the causes that affect the occurrence of undesirable events (accidents, disasters, fires, injuries, etc.), and develop preventive measures that reduce the likelihood of their occurrence.

Any danger is realized, causing damage, for some reason or for several reasons. Without reasons there are no real dangers. Therefore, the prevention of or protection from hazards is based on knowledge of the causes.

Between the realized dangers and the reasons there is a causal relationship; danger is a consequence of some cause (cause), which, in turn, is the consequence of another cause, and so on. Thus, the causes and dangers form hierarchical, chain structures or systems. The graphical representation of such dependencies is somewhat like a branching tree. In the foreign literature devoted to the analysis of object security, terms such as "tree of causes", "tree of failures", "tree of dangers", "event tree" are used.

In the trees under construction, as a rule, there are branches of causes and branches of dangers, which fully reflects the dialectical nature of cause-effect relationships. The separation of these branches is inexpedient, and sometimes impossible. Therefore, it is more accurate to call graphic images obtained in the process of analyzing the safety of objects "trees of causes and dangers". The construction of "trees" is an exceptionally effective procedure for identifying the causes of various undesirable events (accidents, injuries, fires, road accidents, etc.).

A priori analysis. The researcher chooses such undesirable events that are potentially possible for the given system, and tries to make a set of various situations that can lead to their appearance. A posteriori analysis. Runs after unwanted events have already occurred. The purpose of this analysis is the development of recommendations for the future. A priori and a posteriori analyzes complement each other. The direct method of analysis is to study the reasons to foresee the consequences. With the inverse method, consequences are analyzed to determine the causes, i.e. the analysis begins with the event that crowns. The ultimate goal is always the same - preventing unwanted events. Having the probability and frequency of occurrence of primary events, one can, from bottom to top, determine the probability of a crowning event. The main problem in the analysis of safety - the establishment of parameters or boundaries of the system, depending on the specific purpose of the analysis.

Stages of the life cycle. The stages at which safety requirements are to be considered form a full cycle of activities, namely: scientific design, research, development, project, project implementation, testing, production, transportation, operation, modernization and reconstruction, conservation and disposal, burial.

In every human action, psychology distinguishes three components: motivational, indicative and executive. Violation in any of these parts in the performance of any action entails a violation or failure to perform the action as a whole. Why, for example, does a person break rules or instructions? Because, or he does not want to fulfill them, or does not know how to do it. Or maybe he just can not do it.

Thus, we can distinguish three groups of psychological causes of the emergence of dangerous situations and accidents:

Violation of the motivational part of the actions is manifested in the unwillingness to perform certain actions (operations). Violation can be relatively constant, due to the individual qualities of the employee (the person underestimates the danger, is prone to risk, negatively refers to any restrictions, there are no incentives for safe work, etc.). It can be temporary, when a person is in a state of stress, depression or alcoholic intoxication.

Violation of the indicative part of the action is manifested in ignorance of the rules of operation of technical systems and safety standards.

Violation of the executive part manifests itself in the failure to comply with the rules (instructions, norms, regulations, etc.) due to the discrepancy of the individual capabilities of the employee with the requirements of the work performed. Such discrepancy, as in the case of violation of the motivational part of the actions, can be permanent (poor coordination, insufficient concentration of attention, uneasy arrangement of controls, etc.) and temporary (fatigue, disability, deterioration of health, stress, alcoholic intoxication).

Such a classification allows, in accordance with each group of causes of hazardous situations and accidents, to designate appropriate preventive measures. Motivational part is propaganda of safe work; by orientation - training, skills training; on executive - professional selection, medical examination. Designing the security of activities is a difficult process and requires a lot of effort.

Logic-methodological scheme for designing and analyzing the safety of activities

Principles, methods and means of ensuring the safety of activities. The principle is an idea, a thought, a basic position. The method is the way, the method of achieving the goal, proceeding from the knowledge of the most general laws. Principles and methods of ensuring security are special in contrast to the general methods inherent in dialectics and logic. The methods and principles are interrelated in a certain way.

The means of ensuring security are a constructive, organizational, material embodiment, concrete implementation of principles and methods. Principles, methods, means are logical stages of ensuring security, their choice depends on specific operating conditions, security level, cost and other criteria. Principles of safety are many. They can be classified on several grounds.

Principles of safety. The principles of ensuring the safety of activities can be divided into four classes: orienting, managerial, organizational and technical (Table 5.4). All these principles are interrelated and complementary. The orienting principles are based on the basic ideas that guide the search for safe solutions: human factor accounting, the principle of rationing, the system approach. Management principles determine the relationship and relationship between the individual stages and stages of the security process - incentives, the principle of responsibility, feedback, etc.

Organizational principles include the implementation of the principles of rational organization of work, the zoning of territories, the principle of protecting time (limiting the stay of people in conditions when the level of harmful effects is on the verge of permissible) for the purposes of safety. They are aimed at directly preventing the operation of hazards. Technical principles are based on the use of physical laws and involve the use of specific technical solutions to improve safety: maximum reduction in harmful emissions, distance protection, protective earthing, insulation, fencing, shielding, sealing, weak link principle, etc.

Example: Fire is a physical phenomenon, it appears in the following conditions:

1) a combustible mixture;

2) the oxygen level in the air is not less than 14%;

3) source of ignition;

4) emptiness;

5) time.

The principle of destruction - is aimed at finding at least one element in the system of circumstances, the artificial removal of which would prevent an accident (for example, lowering the temperature in the room does not allow spontaneous combustion of fumes of fuel or organic dust);

The principle of hazard reduction is not aimed at eliminating the hazard, but only at reducing its level (for example, reducing the voltage to 36 V when using an electric tool without grounding);

The principle of replacement of the operator is aimed at replacing a person with a robot, machine tools with programmed control;

The principle of eliminating a hazard is to eliminate dangerous and harmful factors in the performance of technological processes (for example, the replacement of dangerous equipment with a safe one, the application of scientific organization of work, etc.);

The principle of classification - is aimed at the distribution of dangerous and harmful factors for certain characteristics, which allows you to make well-founded predictions of unknown facts or patterns. Organizational principles are those principles that, for the purpose of improving safety, contribute to the realization of the position of scientific organization of activity. These include:

a) the principle of time protection - involves reducing the length of time a person is exposed to dangerous or harmful factors to safe values, reducing the time of storage of products and goods in containers to prevent poisoning, explosions and fires;

b) the principle of rationing - consists in the regulation of conditions, the observance of which provides the necessary level of safety (for example, maximum permissible concentration limits for the permissible concentration of harmful substances in the habitat, the level of emissions, the effect of magnetic fields, etc.);

c) the principle of incompatibility - consists in the spatial or temporal separation of objects of the real world in order to prevent their interaction with each other (for example, it is forbidden to store food and toxic chemicals or paints in the same room);

d) the principle of ergonomics - consists in the fact that to ensure safety, anthropometric, psychophysical and psychological properties of a person are taken into account when creating a workplace, a place of rest and social needs;

e) the principle of information - consists in the transfer and assimilation by the personnel of the information providing the necessary level of safety (for example, instruction, training, warning signs, signaling);

e) The principle of redundancy (duplication) - consists in the simultaneous use of several devices, methods, techniques designed to protect against the same hazard (for example, several exits for evacuation in rooms, several engines in an airplane, emergency lighting in buildings with several different sources of energy supply),

g) the principle of recruitment - is the selection of people by specialty, practical experience of work, the formation of the structure of services and departments that would be able to provide the necessary level of safety in the workplace;

h) the principle of consistency - consists in the formation of a certain sequence of operations, processes, routine maintenance to reduce the level of danger (for example, prior to allowing the worker to perform work, safety instruction is given, before the machine equipment is switched on, the inspection is performed).

Security methods. The homosphere is the space (working area) where the person is in the process of the activity under consideration. Noxosphere - a space in which there are always or periodically appear hazards. The combination of the homosphere and the Noxosphere is unacceptable from the standpoint of security.

Security is achieved by three main methods. Method A consists in the spatial and (or) temporal separation of the homosphere and the Noxosphere. This is achieved by means of remote control, automation, robotization, organization, etc. Method B consists in the normalization of the Noxosphere by eliminating hazards.

This is a set of measures that protect people from noise, gas, dust, the danger of injury, etc., by means of collective protection. Method B includes a gamut of techniques and tools aimed at adapting a person to the appropriate environment and increasing their protection. This method implements the possibilities of professional selection, training, psychological impact, PPE. In real conditions, a combination of these methods is realized.

Security Tools. The means of ensuring security are divided into means of collective (PC) and individual protection (PPE). In turn, VHCs and PPE are divided into groups depending on the nature of the hazards, design, scope, etc. In a broad sense, all that contributes to the protection of a person from danger should be included in the means of safety, namely:

education, education, health promotion, discipline, health care, government authorities, etc.

THEME-3

LEGAL, ORGANIZATIONAL AND THEORETICAL FOUNDATIONS OF LIFE SAFETY AND LABOR HYGIENE

Plan:

1. Scope of the law on occupational health and state policy.

2. Providing occupational health.

3. Control authorities in the world of work.

4. Harm to health of employees in production and the responsibility of the employer. General rules.

5. The concepts of injury, accidents and occupational diseases.

6. General rules for the prevention of accidents

7. Verification and recording of accidents in industrial enterprises.

8. Factors that make up working conditions.

9. Analysis of injuries and occupational diseases.

Basic terms - the concept of labor protection; sphere of application of laws; policy of the state; international treaties; ensuring the norm; healthy and safe working conditions; guarantees; normative acts; control of the state and the public; measures of responsibility, accident, trade unions, concentration, employee health; injuries; drawing up of acts; periodic medical examination; expert opinion.

The scope of the law on occupational health and state policy. The legal issues of labor safety are ensured by the Constitution of the country, which guarantees the rights of citizens to work, for living, health care, material security in old age, in case of illness, with full or partial incapacity for work. Since April 1, 1996 The "Labor Code of the Republic of Uzbekistan" was adopted. Many articles of this document reflect the creation of safe working conditions: the regimes of work and rest in the conduct of various jobs, guarantees and compensation for workers in harmful conditions, the specific employment of women and youth, compensation for accidents, control and supervision compliance with labor laws and a number of others.

In chapter XIII. Labor protection requirements:

Article 211. Requirements for labor protection

At all enterprises, working conditions must be created that meet the requirements of safety and hygiene. The creation of such conditions is the duty of the employer.

Requirements for labor protection are established by this Code, legislative and other regulatory acts on labor protection, as well as technical standards. The employer is responsible for violation of labor protection requirements. Further in the articles it is stated that the main task of the state policy in the field of labor protection is the recognition and ensuring the priority of the life and health of employees in relation to the results of the production activity of the enterprise. It is also indicated that each worker has the right to labor protection, which is guaranteed by the state in the person of legislative, executive and judicial bodies.

The State Administration of Occupational Safety is involved in the implementation of the main directions of the state policy in the field of labor protection, the development of legislative and other normative acts in this area, as well as requirements for means of production, technology and labor organization, health workers and health, also lists the rights and duties of employees and employers to ensure labor protection in enterprises, the issues of training and instructing workers in the field of labor protection Yes, information is provided on the financing of these measures and labor protection funds.

In addition, a number of articles in this document provide information on the responsibility of enterprises and employers for non-compliance with the requirements for creating healthy and safe working conditions, specifies how supervision and control over compliance with labor protection legislation should be carried out, and also examined a number of other points.

Article 212. Obligations of the employee for observance of norms, rules and instructions on labor protection.

The employee is obliged to comply with the requirements of the rules, regulations and instructions for labor protection, as well as the order of the administration for the safe conduct of work, use the personal protective equipment received, immediately notify his immediate supervisor (foreman, master, site manager, etc.) of any situation that creates an immediate threat to life and health of people, as well as any accident that occurred during or in connection with the work.

Article 213. Employee's right to information on labor protection.

When concluding an employment contract and when transferring to another job, the employee must be informed by the employer about the working conditions, including the risk of occupational and other diseases that are due to him in connection with these benefits and compensations, as well as personal protective equipment. The employer is also required to inform employees or their representatives about the state of labor protection at specific workplaces and in production.

Article 214. Medical examination

The employer is obliged to organize a preliminary examination of labor contracts and periodic (in the course of work) medical examinations of employees who have not reached the age of eighteen; men who have reached the age of sixty, women who have reached fifty-five years of age; disabled persons; employed in work with unfavorable working conditions, night work, as well as in work related to the movement of transport;

employed at work in the food industry, trade and other industries directly serving the population; pedagogical and other workers of general education schools, preschool and other institutions directly engaged in the education or upbringing of children. The list of works with unfavorable working conditions and other works, during which preliminary and periodic medical examinations are carried out, and the procedure for their implementation are established by the Ministry of Health of the Republic of Uzbekistan. Employees specified in part one of this article do not have the right to avoid medical examinations.

If the said employees refuse to undergo examinations or fail to comply with the recommendations issued by the medical commissions based on the results of the surveys, the employer has the right not to allow them to work. It is not allowed to use labor of workers at work, contraindicated to them for health reasons. The employee has the right to demand an extraordinary medical examination if he believes that the deterioration of his health is related to working conditions.

Employees do not bear expenses in connection with the passage of medical examinations.

Article 215. Conducting the instruction and training of labor protection workers

The employer is responsible for instructing workers in safety precautions, industrial sanitation, fire protection and other labor protection regulations, as well as for the continuous monitoring of employees' compliance with all labor protection requirements. The employer is obliged to ensure that workers receive training in occupational safety and to check their knowledge.

The admission to work of persons who have not received training, instruction and testing of knowledge on labor protection, is prohibited.

Article 216. Funds for labor protection measures

For the implementation of measures for labor protection, funds and necessary materials are allocated in the prescribed manner. Expenditure of these funds and materials for other purposes is prohibited. The procedure for using these funds and materials is defined in the collective agreement, and if it is not concluded, - by agreement between the employer and the trade union committee or other representative body of workers. Labor collectives, their representative bodies control the use of funds intended for labor protection.

Article 217. Provision of workers with milk, preventive nutrition, carbonated salt water, personal protective equipment and hygiene

Workers employed in jobs with unfavorable working conditions are provided free of charge according to established norms: milk (other equivalent food products); therapeutic and preventive nutrition; carbonated salt water (working in hot shops); special clothes, special footwear, other personal protective equipment and hygiene.

The list of such works, the norms of issuance, the procedure and conditions security are established by collective agreements, collective agreements, and if they are not concluded, are determined by the employer in agreement with the representative body of workers.

Article 218. Transfer to an easier or exclusive impact of unfavorable production factors work for health reasons.

Workers needing for health reasons to provide easier or excluding the impact of unfavorable production factors of work, the employer is obliged to transfer, with their consent, to such work in accordance with the medical certificate for a temporary or unlimited term. When transferring for health reasons to an easier or excluding impact of unfavorable production factors, the lower paid work for employees retains the previous average monthly earnings within two weeks from the date of transfer.

Employees temporarily transferred to another lower-paid job due to a disease of tuberculosis or occupational disease are issued, at the time of transfer, but not more than two months, a sick leave allowance in such a amount that together with the earnings for the new job it does not exceed the total actual earnings from previous work. If the other work was not provided by the employer within the time specified in the sick leave sheet, then for the missed days, the benefit is paid on a general basis.

Employees temporarily transferred to lower-paid jobs due to personal injury or other work-related health damage, the employer responsible for the damage to health, pays the difference between the previous earnings and earnings for the new job. Such a difference is paid until the disability is restored or disability is established.

Legislation may also provide for other cases of maintaining the previous average monthly earnings or the payment of the state social insurance benefit when transferring for health reasons to lower-cost or excluding the impact of unfavorable production factors, lower-paid work.

Article 219. The right of an employee to refuse to perform work that creates a threat to his life or health

The employee immediately notifies the employer about the occurrence in the course of the work of circumstances that threaten his life or health. When these circumstances are confirmed by the bodies that supervise and monitor the observance of labor protection, the employer takes measures to eliminate them. If the necessary measures have not been taken, the employee has the right to refuse to perform the relevant work until the circumstances that threaten his life or health are eliminated. For this period, the employee retains his average earnings.

Article 220. Additional measures for the protection of the work of the disabled

The employer is obliged to employ disabled persons sent by the local labor authority in order to find workplaces for the established minimum number of jobs. (As amended by Law No. 681-I of August 29, 1998) Recommendations of the WTEC on part-time work, reduced workload and other working conditions for disabled people are mandatory for the employer. Persons with disabilities in Groups I and II are given a reduced working time of no more than thirty-six hours per week without a reduction in wages. Invalids of Groups I and II are granted an annual basic extended leave of at least thirty calendar days.

Involvement of people with disabilities to work at night, as well as overtime work and work on weekends, is allowed only with their consent, provided that such work is not prohibited by medical recommendations.

Article 221. Provision of first medical aid to workers and their transportation to medical and preventive institutions

The employer is obliged to take measures aimed at rendering first medical aid to workers who fell ill at the workplace. Transportation to health-care institutions of workers who fell ill at the workplace, if necessary, is carried out at the employer's expense.

Article 222. Accounting and investigation of accidents at the production

The employer must timely investigate and record accidents at work. At the request of the injured, the employer is obliged to issue an act on the accident not later than three days after the end of the investigation.

Article 223. Supervision and control over the state of labor protection

State supervision and control over the state of labor protection is carried out by state bodies. Public control over observance of norms and rules on labor protection is carried out by trade unions and other representative bodies of workers.

Providing occupational safety and health CHAPTER XIV. Additional guarantees and benefits for certain categories of employees

§ 1. Additional guarantees for women and persons employed family responsibilities

Article 224. Guarantees for the employment of pregnant women and women with children

It is forbidden to deny women in hiring and reducing their wages for motives related to pregnancy or the presence of children. In case of refusal to employ a pregnant woman or a woman with a child under the age of three, the employer must inform them of the reasons for refusal in writing. The refusal to hire these persons may be appealed to the court.

Article 225. Work on which the employment of women is prohibited

It is forbidden to employ women's labor in unfavorable working conditions, as well as underground work, except for some underground works (non-physical works or sanitary and household services). It is forbidden to lift and move women by weight, exceeding the maximum permissible standards for them.

The list of works with unfavorable working conditions on which the use of women's labor is prohibited and the maximum permissible load standards for women when they are lifted and moved by weight are established by the Ministry of Labor of the Republic of Uzbekistan and the Ministry of Health of the Republic of Uzbekistan in consultation with the Federation

Council of Trade Unions of Uzbekistan and representatives of employers.

Article 226. Transfer of pregnant women to an easier or excluding impact of unfavorable production factors work.

Pregnant women, in accordance with the medical conclusion, reduce the norms of production, the norms of service or they are transferred to an easier or excluding impact of unfavorable production factors, while maintaining the average monthly earnings from previous work. Until a decision is made to grant an easier or unfavorable working factor to a woman, she must be released from work while maintaining an average monthly earnings for all workdays that are missed.

Article 227. Transfer to easier or excluding the impact of unfavorable production factors the work of women with children under two years of age

Women who have children under the age of two years, in case of impossibility of performing the previous work, are transferred to an easier or excluding impact of unfavorable production factors, while maintaining the average monthly earnings for the previous work until the child reaches the age of two.

Article 228. Restriction of women's labor at night, overtime, work on weekends and sending them on a business trip

It is not permitted to involve pregnant women and women with children under the age of fourteen (disabled children - up to sixteen years of age), without their consent, to work at night, overtime, weekend work and travel. At the same time, pregnant women and women with children under three years of age can be involved in night work if there is a medical certificate confirming that such work does not endanger the health of the mother and the child.

Article 229. Establishment of part-time work for women and persons engaged in the performance of family responsibilities

At the request of a pregnant woman, a woman who has a child under the age of fourteen (a disabled child - up to the age of sixteen), including her caregiver or a person caring for a sick family member in accordance with a medical certificate, the employer must establish part-time or part-time work (art. 119).

Article 230. Additional day off

One of the parents (guardian, guardian) raising a disabled child before he is sixteen years of age is granted one additional day off per month with payment of his day salary at the expense of state social insurance.

Article 231. Benefits for women in determining the order of granting annual leave

Pregnant women and women who give birth to a child receive annual leave at their option, respectively, before or after maternity leave or after a childcare leave.

Lonely parents (widows, widowers, divorced, single mothers) and the wives of conscripts who bring up one or more children under the age of fourteen (disabled child - up to sixteen years of age), annual holidays are optional, if they wish, in the summer or at another time convenient for them (Article 144).

Article 232. Additional leave for women with children under the age of twelve years or a disabled child under the age of sixteen

Women who have two or more children under the age of twelve or a disabled child under the age of sixteen are granted an additional yearly paid leave of at least three working days each. Women who have two or more children under the age of twelve or a disabled child under the age of sixteen are granted, on their request, annually leave without pay for at least fourteen calendar days. This leave may be added to the annual leave or used separately (in whole or in parts) during the period established by agreement with the employer.

Article 233. Maternity leave

Women are granted maternity leave lasting seventy calendar days before delivery and fifty-six (in case of complicated birth or at the birth of two or more children

- seventy) calendar days after childbirth with payment of the allowance for state

Maternity leave is calculated in total and is provided to the woman completely, regardless of the number of days actually used before delivery.

Article 234. Leave for the care of a child under two and three years of age

At the end of the maternity leave, at the request of the woman, she is granted leave to take care of the child until the age of two years, with payment for this period of the benefit in the manner prescribed by law.

A woman, at her request, is also granted additional leave without pay to care for the child until he reaches the age of three.

Leave for childcare can be used in full or in parts also by the father of the child, grandmother, grandfather or other relative actually caring for the child. At the request of a woman or persons referred to in part three of this article, while on parental leave, they may work part-time or in agreement with the employer at home. At the same time, they retain the right to receive benefits (part one of this article).

During the leave to care for the child, the woman retains a place of work (position). These holidays are included in the work experience, including in the length of service in the specialty. In the work experience entitling to the subsequent annual paid leave, the leave to take care of the child shall not be counted, unless otherwise stipulated in the collective agreement, as well as in another local act of the enterprise or in the employment contract.

Article 235. Leave to persons who adopted newborn children or have established custody of children

Persons who adopt newborn children directly from the maternity hospital or have established custody of them are granted leave for the period from the date of adoption (establishment of custody) and until the expiry of fifty-six (with the adoption (establishment of custody) of two or more newborn children - seventy) calendar days from the day birth of a child with payment for this period of benefits for state social insurance and, at their request, additional leave to care for the child until he reaches the age of three years (Article 234).

Article 236. Breaks for feeding a child

Women with children under the age of two years are provided with additional breaks for feeding the child in addition to the break for rest and nutrition. These breaks are provided no less than three hours with a duration of at least thirty minutes each. In the presence of two or more children under the age of two, the duration of the break is set for at least an hour. Breaks for feeding a child are included during working hours and paid for by the average monthly earnings.

At the request of a woman who has a child, breaks for feeding a child can be attached to a break for rest and nutrition, or transferred in summary form at the beginning and at the end of the working day (working shift) with the corresponding reduction. The specific duration of these breaks and the procedure for their provision are established in the collective agreement, and if it is not concluded, - by agreement between the employer and the trade union committee or other representative body of the employees.

Article 237. Guarantees for pregnant women and women with children, upon termination of the employment contract.

Termination of the employment contract with pregnant women and women with children under the age of three on the initiative of the employer is not allowed, except in cases of complete liquidation of the enterprise, when the termination of the employment contract is allowed with compulsory employment. Employment of these women is made by the legal successor of the liquidated enterprise, and in the absence of successors, the local labor authority ensures the compulsory provision of assistance in selecting suitable work and employment, with the provision of appropriate social payments during the period of employment established by law.

Mandatory employment of women referred to in part one of this article shall be carried out by the employer also in cases of termination of the employment contract due to the expiry of its term. For the period of employment for them, wages remain, but not more than three months from the date of termination of the fixed-term employment contract.

Article 238. Guarantees and benefits to persons raising children without a mother

Guarantees and benefits granted to women in connection with maternity (restriction of night work and overtime, attraction to work on weekends and sending on business trips, as well as the provision of additional holidays, the establishment of preferential working conditions and other guarantees and benefits, established by legislative and other normative acts on labor) apply to fathers who raise children without a mother (in the event of her death, deprivation of parental rights, long stay in a medical institution and in other cases lack of maternal care for children), as well as guardians (trustees) of minors. The guarantees and benefits specified in Paragraph one of this Section are also granted to a grandmother, grandfather or other relatives who actually bring up children deprived of parental care.

Control bodies at work

Control and supervision of the proper organization of work on health services at enterprises and construction sites are carried out by state and trade union organizations.

State supervisory bodies:

1. Gosgortekhnadzor supervision of compliance with the rules for the installation and proper operation of pressure plants, lifting devices, gas installations, and for blasting operations. Gosgortekhnadzor has specialized inspections: Kotlo-supervision, Gas and Gornaya.

Boiler inspectors provide registration and issue a permit for the operation of lifting cranes, elevators, boilers, pipelines for steam hot water. The gas inspection monitors the facilities, technical condition and maintenance of operation in accordance with the rules of the gas installations, instruments and communications.

The Mining Inspectorate provides control over the correct storage, issuance and accounting of explosives, as well as for the safe conduct of blasting operations. Gosenergonadzor is implemented by the State Inspectorate for Energy Supervision (energy sales). The bodies of state energy oversight supervise the implementation by the enterprises of electricity, electricity and PTB during the operation of electrical installations of consumers and rules for the use of electric energy.

Sanitary Inspection - The Chief Sanitary and Epidemiological Department of the Sanitary and Epidemiological Station of the Ministry of Health of the Republic supervises the sanitary hygiene measures that ensure prevention of occupational and infectious diseases, improvement of working and living conditions for workers and environmental protection.

4. Pozhnadzor - supervision of compliance with the requirements of fire safety regulations.

Higher supervision of compliance with labor laws, the implementation of rules and norms of TB, industrial sanitation, fire safety, is entrusted to the Prosecutor General and the justice bodies.

The technical inspector of the trade union of workers of communication and the regional council of the trade union has the right at any time to inspect the communication enterprise for checking the conformity of equipment of machines, mechanisms, requirements of safety rules, sanitary condition of production and auxiliary premises, requirements of sanitary standards, observance of working and rest regimes, specialist. clothes, specials. footwear, special. nutrition and protective equipment.

At each enterprise, the trade union committee is elected, with it there is a labor protection commission headed by a senior public inspector who monitors the implementation of the collective agreement, participates in the investigation of accidents, and also checks knowledge of the safety rules. In shops and departments of the members of the trade union, a public inspector for labor protection is elected who controls the serviceability of equipment, tools, fences and locks in the workplace, the work of computational installations and heating systems, the state of lighting, monitors the cleanliness and order, it monitors the conduct of instruction in the workplace, the study of safety instructions by all workers of the shop, observance of the time and order operating modes, granting holidays, providing workers with protective equipment. The public inspector is obliged to inform the master or the chief of the shop about all the shortcomings observed and, together with him, to develop measures to eliminate these shortcomings. All members of the labor safety committee participate in the development of measures for the protection of labor in collective collective agreements, which is concluded annually between the FMCM on behalf of the collective of workers and employees and the administration of the enterprise: and establishes mutual obligations of the administration and collective of the people. The contract contains an agreement on labor protection, consisting of 3 sections:

Measures for the prevention of accidents.

On the prevention of prof. diseases at work.

On the overall improvement of working conditions.

They are financed through shop and general factory overhead costs, public investment, bank credit. It is strictly forbidden to spend funds allocated to labor protection measures for other purposes. The agreement specifies the terms and persons responsible for execution. At the end of the year, a report on the implementation of measures and the development of funds allocated for labor protection is heard.

Strict state, departmental and public supervision and control are established for the state of work safety. State supervision is carried out by special state bodies and inspections, which in their activities do not depend on the administration of controlling enterprises. These are the Prosecutor's Office of the Republic of Uzbekistan, the mining and industrial supervision of the Republic of Uzbekistan, the supervision of Uzbekistan on nuclear and radiation safety, the State Energy Supervision of the Republic of Uzbekistan, the State Committee for Sanitary and Epidemiological Surveillance of the Republic of Uzbekistan, the Labor Inspectorate under the Ministry of Labor of the Republic Uzbekistan;

General supervision over the implementation of the laws in question is entrusted to the Prosecutor General of the Republic of Uzbekistan and local prosecutors. Supervision over observance of the legislation on labor safety is also entrusted to the trade unions of the Republic of Uzbekistan, which monitor security in production through the technical inspection of labor.

Control over the state of working conditions at enterprises is carried out by specially created labor protection services jointly with the trade union committee. Control over the condition of labor conditions consists in checking the condition of the working conditions for employees, identifying deviations from safety requirements, labor legislation, standards, labor safety rules and regulations, regulations, policy documents, as well as checking the performance of services, units and individual groups of their duties in the field of labor protection. This control is carried out by officials and specialists approved by the order for the administrative division.

Responsibility for the safety of labor in the enterprise as a whole is borne by the director and chief engineer. Departmental labor protection services in conjunction with the committee of trade unions develop labor safety instructions for various professions taking into account the specifics of the work, as well as conduct instruction and training of all working safety administrators. There are the following types of instruction: introductory, primary in the workplace, repeated extra-routine and current.

Introductory coaching is conducted with all workers and employees regardless of the profession prior to hiring, as well as with visiting and students who have come to practice. The main issues addressed in the introductory text, and the approximate time spent on their presentation (min) are presented below:

• The main provisions of the legislation on labor protection – 10

• Rules of internal order and mode of operation – 10

• The order of promotion in the zone of production of work special working conditions in certain areas - 10

• General requirements for occupational safety at work – 20

• Electrical safety regulations – 10

• Requirements for fire safety – 10

• The procedure for obtaining tools, overalls, special footwear,

• Safety devices – 5

• Rules for industrial sanitation and personal hygiene – 5

• Ways to provide first aid for the first time – 10

• The order of registration of documents in case of accidents

• in production

Primary briefing at the workplace is carried out by the immediate supervisor of work before being allowed to work. This kind of briefing should be accompanied by a demonstration of safe working methods.

Re-structuring the workplace is conducted with employees regardless of their qualifications, experience and payment of work at least every six months. The purpose of this Instruction is to restore in the memory of the working instruction on the protection of labor, and also to disassemble specific violations from the practice of the enterprise. Unplanned work in the workplace is carried out in the event of changes in the rules on labor protection, technological process, violation of safety rules by workers, in the event of an accident, during work breaks - for jobs that require additional safety requirements - more than 30 calendar days, for the remaining work - 60 days. Current instruction is carried out for workers who are issued an outfit for certain types of work. The results of all types of briefing are recorded in special journals. For violation of all types of legislation on safety of life, the following responsibility is provided:

disciplinary, which imposes on the offender a superior administrative person (comment, reprimand, transfer to a lower-paid position for a certain term or demotion, dismissal);

administrative (employees of the administrative and administrative apparatus are exposed, expressed in the form of warning, public censure or fine);

criminal (for violations that entailed unfortunate cases or other severe consequences);

material, which in accordance with the current legislation is borne by the enterprise as a whole (fines, payments to the injured as a result of accidents, etc.) or the guilty officials of this enterprise.

Organization of work on labor protection in enterprises and monitoring their implementation. The structural diagram of the organization of work on labor protection at communication enterprises, as well as the organization of control and supervision by state and trade union bodies is shown in the figure.

The Uzbek Agency for Communication and Informatization plans measures for labor protection and exercises control over their implementation.

In the production and technical communications offices (PTUC), the work on labor protection is organized by chiefs, chief engineers and deputy chiefs of the PTUC. The head of the enterprise is responsible for the organization of labor protection in the enterprise as a whole, and the chief engineer and deputy chief bear full responsibility for complying with the labor legislation, safety rules and regulations, industrial sanitation, fire safety in subordinate departments, shops, and sections.

To monitor the performance of work on labor protection, an occupational safety engineer is appointed, reporting to the chief engineer. The manager is obliged to know the list of works with increased danger, to monitor the availability and working condition of protective equipment and safety devices, to properly operate ventilation systems, lighting workplaces, to reduce noise and vibration, organize training of workers and employees in safe working methods, conduct periodic tests of knowledge safety rules.

The supervisor must also suspend the work of persons who do not comply with safety rules and regulations, stop the mechanisms if they threaten the life and health of people, organize first aid to the victim, participate in the investigation of accidents and take measures to prevent them. In order to strengthen control over the implementation of measures aimed at reducing injuries and improving working conditions at the telecommunications enterprise, a 3-step control over the state of labor protection is introduced.

Every month the chief engineer and labor safety engineer checks the state of labor protection in general for the enterprise, controls the elimination of deficiencies identified at the 1st and 2nd stages of the audit. The results of the inspection are documented by the order on the enterprise. The occupational safety engineer systematically monitors the implementation of safety rules and regulations, industrial sanitation, orders of higher organizations, as well as supervisory bodies. He conducts an introductory briefing with the newly-admitted employees, participates in the work of the commission for the testing of safety knowledge and in the investigation of accidents at work.

Annually enterprises compile reports on the implementation of the integrated plan under the form N21-T and send them to higher economic and trade union organizations. The reports include information on the number of employees in unfavorable conditions and those for whom they are given in accordance with the standards in the reporting year. The report contains data on the volume of works performed for the reconstruction, overhaul and decommissioning of plants, workshops, sites that do not meet the requirements of safety rules and regulations.

Administrative, economic and engineering personnel of telecommunications enterprises that violate labor legislation, labor protection rules, may be brought to disciplinary, administrative or criminal liability.

Damage to the health of employees in production and the responsibility of the employer. General rules. The degree of counteraction to the hazards arising in the course of work is determined by:

- biological factor, manifested in unconscious self-regulation and resulting from the natural properties of man;
- psychophysiological qualities and human condition;
- professional qualities and experience;
- level of motivation for work and safety.

Consider the above factors in more detail. The person's natural ability to work safely depends on his nervous system: readiness to perform a certain action, features of perception and attention, sensorimotor coordination. In the process of changing the conditions for its implementation, therefore, a person has to constantly adapt to them. A worker with a good switchability, who has solved the same problem, has an installation for success in solving the next. Conversely, people with slow and delayed switching tend to make mistakes and therefore fall into dangerous situations.

The features of the perception of individual objects in the surrounding field (background) have a noticeable effect on the process and result of activity. It is established that people who perceive objects regardless of the surrounding field ("hollow") act more successfully and safely.

Attention is the ability of a person to concentrate on the problem being solved with simultaneous cutoff of extraneous signals. This quality is considered a good indicator of people's ability to work safely. Controlling in the process of activity a large number of parameters and being at the same time a single-channel system, a person is forced to redistribute attention depending on the degree of importance of the parameter at each particular moment in time. The success of such actions largely depends on the safety of the execution of operations of the labor process.

Emotional stability is manifested in the preservation of a person's self-control and working capacity when exposed to various stimuli. Employees with poor adaptability to such influences are more likely to fall into dangerous situations than representatives of a similar profession who do not have this shortcoming. Mental personality qualities are formed on the basis of natural, but mostly they are formed under the influence of social environment and activities. The decisive role is played by the conditions and methods of educating a person. To the personal qualities that increase the propensity of people to incidents, include: increased conflictness, high sensitivity to violations of the normal course of work, bad relationships with colleagues, domestic troubles, the desire to stand out (most often risky behavior), excessive care for one's own health. Generalizing indicators of professional qualities required for any type of activity are the skills and skills developed for it. The skills are understood as the element of objective action automated as a result of training, and by skill - the ability of a person to freely dispose of acquired skills depending on the situation or working conditions.

In the presence of sufficiently strong skills, the main reason for erroneous actions is an incorrect evaluation of the conditions for performing this action. For example, people, bringing to automatism this kind of movement, like walking on a flat horizontal surface, often get injured if there are slippery areas on it that are initially taken for absolutely safe.

An important indicator of a person's professional qualifications is the length of his work. There are two peaks of injuries: the first - at the beginning of the development of the profession, which is determined by the inexperience of the workers, and the second - through Z ... 5 years of work, when there is the confidence to work safely with even a little more experience. The human exposure to accidents is predetermined by his health. Particularly unfavorable are the presence of chronic diseases (cardiovascular, nervous system, etc.), which cause malaise, weakness, fatigue, and increased irritability. People with such diseases are not suspended from work due to medical norms, and therefore they are not protected from occupational hazards.

A bad mood, a state of alcoholic or narcotic intoxication, fatigue, biological rhythms can also lead to an accident. The repetition of the latter is related to a person who has been previously experienced the same case. There is an effect, discovered by the English psychologist Carpenter, that every perception generates a propensity for a similar perception. In other words, after an accident the worker is not sure of the possibility of avoiding him in the future and he is in a state of "traumatic neurosis". A person is tuned to commit an error, and the accompanying fear gives rise to excitement, which actually leads to repeated injuries.

The reasons for the occurrence of an accident are being in a dangerous zone and a simultaneous violation of safety rules, as well as a combination of a number of circumstances - a combination of random and necessary. There is a statistically confirmed pattern showing that out of 1500 violations of safety rules 300 situations create dangerous situations, 29 of which result in minor injuries and one of which is severe.

In agriculture, injuries are 1.4 times higher than in industry. This is facilitated by the characteristics of the labor process in this industry. Many types of work are performed at remote sites relative to one another. A significant number of works in plant growing and partly in animal husbandry are performed outside the premises under various, most often unfavorable conditions.

Technological processes are associated with the use of electricity, the sources of which are located in rooms with a high degree of danger of electric shock and even in especially dangerous ones, which aggravates the severity of electric trauma. Workers in a number of professions, in the nature of their activities, are in contact with infected material, sick animals, poisonous and aggressive substances. Weather conditions also affect the rhythm of the work process.

The crowding of people, the presence of noise, various hazards in individual production facilities, lifting and carrying weights in combination with body hypothermia adversely affect a person. Thus, the degree of exposure to hazards (risk) is the result of the complex interaction of a person, the production and the system of ensuring labor safety in this production. Responsibility of officials for violation of legislation on labor protection Investigation, registration and recording of accidents related to production

Officials guilty of violating labor legislation and labor protection regulations, in default of obligations under collective agreements and agreements on labor protection or in hindering the activities of trade unions, bear responsibility (disciplinary, administrative, criminal and material) in the manner established by the legislation of the Republic of Uzbekistan.

Disciplinary responsibility occurs when, through the fault of officials from among the leading, administrative-technical and administrative-economic employees, violations of labor protection are allowed, which do not entail serious consequences and could not entail them. Attraction to disciplinary liability is expressed in declaring the guilty person disciplinary punishment.

Administrative liability for violation of labor protection legislation is expressed in the imposition of monetary fines on guilty officials. The right to impose fines is used by: Chief technical and technical inspectors of trade unions, Gosgortechnadzor bodies, State sanitary inspection bodies, as well as inspections of some ministries and fire inspectors.

Criminal liability for violation of the rules for safety precautions, industrial sanitation and other rules of labor protection occurs when these violations could entail or entailed accidents with people or other serious consequences. This criminal liability can only be borne by those officials who, due to their official position or under special order, have a duty to protect labor and observe safety rules at the relevant site of work or monitor their implementation.

The liability of officials for violation of labor protection rules arises if as a result of such a violation an enterprise (institution, organization) is obliged to pay certain monetary sums to the injured person or to social insurance (social security) bodies. Investigations are subject to accidents that occur both during working hours (including set breaks), before and after the beginning of work, as well as during work in overtime, on weekends and holidays.

Acute poisoning, heat strokes, and frostbite are investigated as accidents. The results of an investigation of an accident at work that caused a disability for at least one working day are documented by an act in the form of H-1. A victim or an eyewitness of an accident immediately notifies the master, the head of the workshop or the relevant work manager about every accident at work. The master, having learned about the accident, should organize the first aid to the victim and send it to the medical center, and inform the chief of the workshop or the relevant work manager about the incident.

In a special order to be investigated and recorded group (occurred with two or more employees), severe and fatal accidents. Responsibility for the correct and timely investigation and recording of accidents, as well as for the implementation of activities specified in the certificate, shall be borne by the head of the enterprise or institution, chief engineer, shop managers, masters and other heads of the relevant sections. The concept of trauma and occupational diseases Trauma (from the Greek - wound, damage) is a violation of the anatomical integrity or physiological functions of the tissues or organs of a person, caused by a sudden external impact.

The case with the worker, associated with the impact on him of a hazardous production factor and accompanied by injury and disability, is considered by the legislation of the Republic of Uzbekistan as an industrial accident. An occupational disease is a violation of the health of the worker, caused by the influence of harmful working conditions on him, as well as the prolonged exposure to unfavorable working conditions.

On social significance, all injuries can be divided into production and non-production.

• The source and nature of injury injuries are:

• mechanical (dislocation, fracture, cut, bruise, etc.);

• thermal (thermal burn and frostbite);

• chemical (chemical burn, poisoning);

• electrical (electrical burns and marks, skin metallization, electro-ophthalmia, paralysis, etc.);

• mental (fright, nervous shock);

• radiation (radiation burns).

By severity of the consequences of injury can be divided:

• on microtraumas - eliminate directly on the workplace. Loss of ability to work does not exceed one working shift;

• lungs - temporary disability with its subsequent full recovery during treatment;

• severe - permanent partial or total loss of ability to work and transfer of the victim to a disability (according to the scheme for determining the severity of accidents at work, which includes fractures of the bones of the arch and the base of the skull, jaws, injuries of the thoracic and abdominal cavity, vertebral dislocations and etc.);

• deadly - lead to the death of the victim, which can occur at the time of the accident, and after any time after it, for example in the process of treatment.

Localization distinguishes traumas of the eyes, legs, head (except eyes), trunk, fingers, hands (except fingers), and multiple. Occupational diseases or poisoning occur as a result of exposure to industrial hazards. Acute occupational poisoning is characterized by the entry into the body of relatively large amounts of harmful substances during one work shift and by vivid clinical manifestations immediately at the time of the action of the poison or in a relatively short (several hours) latent period.

Chronic occupational poisoning occurs gradually with prolonged action of industrial poisons, penetrating into the body in relatively small amounts. An acute occupational disease occurs after a single (not more than one shift) exposure to high concentrations of chemicals in the air of the work area, as well as levels and doses of other unfavorable factors. Chronic occupational disease is possible with long-term effects on the human body of harmful or unfavorable working conditions. When diagnosing professional poisoning or illness, doctors are guided by a list of diseases that can be recognized as professional: chronic dust bronchitis; infectious and parasitic diseases, homogeneous with the infection with which workers are in contact during work (brucellosis, tuberculosis, rabies, etc.); professional neoplasms (skin tumors, lung cancer, etc.); acute and chronic skin diseases;

chronic relapsing laryngitis, scabies spasm, etc. The final diagnosis of chronic forms of diseases (poisonings) is established in the centers of occupational pathology on the basis of clinical data on the worker's health status, extracts from the patient's medical record, information on the results of preliminary and periodic medical examinations, sanitary and hygienic characteristics working conditions and a copy of the work book. After that, the specialists of the center draw up a medical report and send relevant notices to the state sanitary and epidemiological supervision agency, the employer, the insurer and the health care institution that sent the patient.

Checking and recording accidents in industrial plants

Each accident, drawn up by an act in the form of H-1, is included in the statistical report on temporary incapacity for work and injury at work (form No. 7-traumatism).

The state statistical reporting forms No. 7 are submitted quarterly (on the 25th day after the reporting period) and fill in the cumulative total of all enterprises and organizations to the relevant statistical agency, and also annually (by January 25) of its parent organization. The report is signed by the head of the enterprise. To correctly assess the state of injury at this or that enterprise, the following indicators (coefficients) are used. The rate of injury is the number of accidents for the accounting period (including fatalities) per 1,000 workers, that is,

$$Кч=1000Н/Р$$

where H is the number of accidents for the accounting period; P - the average number of employees at the enterprise for the accounting period.

The coefficient of gravity characterizes the average length of incapacity for work of the victims, i.e.,

$$КТ=Д/Н1$$

where D is the number of days of incapacity for work for all victims during the accounting period; H1 - the number of accidents for the accounting period, which does not include fatal accidents. The loss factor of working time shows the number of days of disability for the accounting period per 1000 employees:

$$Кп = RчRт=1000Д/Р.$$

Fatal accidents are counted separately by the absolute number of fatal accidents Hcm. Coefficient of the frequency of fatal accidents:

$$Kch.sm = 10000Hcm / P.$$

Factors that make up the working conditions To reduce and prevent injuries, the following organizational and technical and constructive measures are carried out:

improvement of fencing constructions;

periodic inspection of load lifting machines and power equipment;

conducting periodic checks of the condition of electrical equipment;

control of the technical condition of tools, machines and equipment, reliability of PPE;

carrying out preventive maintenance and maintenance (TO) of machines.

Improvement of working conditions is the normalization of the temperature-humidity regime and the speed of air movement, the selection of correct lighting, the reduction of concentration or levels of harmful production factors to the maximum permissible values. In accordance with the Regulations on the procedure for attestation of workplaces for working conditions approved by Decree No. 12 of the Ministry of Labor and Social Development of the Republic of

Uzbekistan on 14.03.1997, annual certification (certification) of working conditions is carried out based on the order of the head of the economy - documenting their actual status with the purpose of identifying hazardous and harmful production factors.

For this purpose, initiative groups are created, which include chief specialists (shop managers), heads of primary production units, a labor protection specialist and a representative of the trade union committee of the enterprise.

The actual state of the working conditions is assessed after performing special instrumental measurements of the levels or determining the state of the factors of the production environment, the values of which are recorded in the working conditions map at the workplace. If the values obtained are equal to or lower than the maximum permissible concentrations (MPC) and maximum allowable levels (PDE), then in the corresponding graph of the card the working conditions are marked with a dash.

The severity and hazards of the factors of the work environment, the severity and intensity of the work process are assessed in terms of the Hygienic evaluation criteria and the classification of working conditions in terms of the hazards and hazards of the factors of the working environment, the severity and intensity of the labor process put into effect on 01.09.1999. For each factor, they are placed in the working conditions map. The influence of each specific factor on the state of working conditions is carried out taking into account the duration of its effect on workers, which changes the score. The class of working conditions is determined by the sum of the points scored. Based on the results of the certification of workplaces, the managers of the production units in accordance with the Recommendations on the planning of labor protection measures approved by the Decree No. 11 of the Ministry of Labor of the Republic of Uzbekistan on 27.02.1995 develop measures to improve labor protection in their entrusted areas. On the basis of primary developments, the main specialists make up the activities by sectors submitted to the head of the economy after preliminary agreement with the labor protection specialist.

The head of the economy, using action plans for the sectors, together with the trade union committee and the occupational safety specialist, draw up a plan of measures to improve labor protection in the household as a whole, attached to the collective agreement (agreement on social issues), which, after approval at the general trade union meeting, becomes the main document on the work in this area.

To improve working conditions, the following measures are taken: reduce to regulated levels of concentration of harmful substances in the air of the work area; use new and reconstruct the existing heating and ventilation systems in production and household premises; provide the required natural and artificial lighting in workplaces, territories, in workshops and household premises; expand, reconstruct and equip the sanitary facilities (dressing rooms, showers, rooms for personal hygiene of women, etc.); create shelter from sunlight and atmospheric precipitation when working in the open air, etc.

The plans do not include measures to reduce or eliminate pollution of air and water basins, which have as their primary goal the creation of normal sanitary conditions for residential areas located near the enterprise; color decoration of walls, ceilings, structures, equipment; Artistic design, which, in essence, is a means of improving equipment; improvement of the territory of the enterprise and its landscaping; current repair and maintenance of machinery and equipment, fences and safety devices, sanitary appliances.

For the time necessary to normalize or improve working conditions in the workplace, the head of the enterprise, in agreement with the trade union committee, is given the right to introduce differential subsidies up to 12% of the tariff rate for jobs with heavy and harmful working conditions and up to 24% of the tariff rate for jobs with particularly heavy and especially harmful working conditions. After the actions specified in the plan are fulfilled and the workplaces are brought to a proper state, surcharges are canceled. The administration is obliged to carry out activities under the collective agreement, and the trade union committee - to monitor the implementation and report this to the general meeting of the collective of the enterprise.

Annex 1

"Approve" the form H1

Shipped by the employer for 1 copy_________________ -the victim (if he died, (the family of the signatory) full name) - the head ______ year ________ of the labor protection service (engineer, specialist) -state labor inspector ACT No. _____ About the caused harm to health or an accident in manufacture

1. Name of the enterprise ___________________

1.1. Company address _______________________

(region, city, district, street, house)

1.2. Type of ownership_________________________

(state, joint-stock, private and etc.)

1.3. Place of Accident Accident ________________

(department, shop)

2. Ministry, corporation, association, concern ________________________

3. The company that sent the employee ___________________________________

(name, address,

ministry____________________________________

(corporation, association, concern)

4. Name of the victim ____

____

5. Sex: a man is a woman (underline the necessary) _____________________________

6. Age (indicate the number of full years) ____________________________________

7. Profession, position ___________________

7.1. Rank, class ________________________

8. Work experience at the time of accident accident _________________

9. Direction on labor protection:

9.1. Input direction (date) ____________

9.2. Training on labor protection (date) ____________________________________

9.3. Primary (intermediate) direction (date) __________________________

9.4. Check of knowledge on super dangerous works (date) _________________________

9.5. Medical examination at employment ________________________

10. Date and time of incident of accident _____________________________

(year, day, month)

____

(the number of full hours of work start)

11. The state of the accident ____

11.1. Causes of the accident ________________ _________________________

11.2. The tool that caused the accident ____________________

11.3. Sobriety of the victim (state of alcoholic or narcotic intoxication)

(according to the medical report)

11.4. Diagnosis

____

(initial, final)

12. Accident prevention measures:

No. Name of the measures Deadline Executor Executing note

13. Persons who committed violations of laws, rules

____

(Full name, position, company)

____

(broken laws, rules)

14. Witnesses of an accident _____________

____

Date _______________________________

Head of the Commission ________________

(Full name, signature)

Members of the Commission

____

(Full name, signature)

THEME 4.
PRODUCTION SANITATION AND HYGIENE OF LABOR

Plan:

1. Description of the electromagnetic field.
2. The effect of variable electromagnetic fields on the human body.
3. Norms of the electromagnetic field. Methods of protection.
4. Protection against laser beams.
5. Protection from radioactive rays.
6. Effects of radioactive rays on the human body.
7. Emission standards.

Basic phrases: *microclimate, air environment of the work zone, vibration, ventilation, lighting, hygienic standards, electromagnetic field, electromagnetic radiation, alternating electromagnetic field, laser* *beams, radioactive radiation, strength of the energy flow, electrical (E) and electromagnetic (H) radioactive substances.*

Industrial microclimate and air environment of the working area

Microclimate parameters. The optimum and permissible values of temperature, relative humidity and air speed for various operating conditions are normalized.

Noise. For noise, permissible sound pressure levels in dB in octave bands with average geometric frequencies of 63, 125, 250, 500, 1000, 2000, 4000, 8000 Hz are established, as well as sound levels and equivalent sound levels in dB. In the normalization of noise, the nature of the objects and the type of work performed are taken into account. Illumination. In the normalization of illumination, the size of the object of discrimination (mm) is the determining factor, according to which the discharge of visual work is determined. The natural illumination is normalized by the coefficient of natural illumination. For side lighting, the minimum value is normalized, and for the upper and combined - the average. The smallest artificial illumination on working surfaces in production premises is established taking into account the background, the contrast of the object with the background, the lamps used and the type of lighting. Hygienic rationing of microclimate parameters

When considering the intensity of labor, all types of work, based on the total energy expenditure of the body, are divided into three categories: light, medium and heavy. Characteristics of industrial premises according to the category of works performed in them are determined according to the category of work performed by 50% or more working in the corresponding premises.

Light work (category I) with an energy consumption of up to 174 W includes works performed sitting or standing, not requiring systematic physical stress (the work of controllers, in the processes of precision instrumentation, office work, etc.). Light work is divided into category Ia (energy costs up to 139 W) and category Ib (energy costs 140 ... 174 W). Works with an average severity (category, II) include work with an energy expenditure of 175 ... 232 W (category IIa) and 233. ..290 W (category IIb). The category IIa includes work related to constant walking, performed standing or sitting, but not requiring the movement of weights, to category IIb - work related to walking and carrying small (up to 10 kg) weights (in machine-assembly shops, textile production, processing wood, etc.).

For heavy work (category III) with an energy expenditure of more than 290 W, there are jobs associated with systematic physical stress, in particular with constant movement, with the transport of significant (more than 10 kg) weights (in forging, foundries with manual processes, etc.).

In these norms, each component of the microclimate in the working area of the production room is individually normalized: temperature, relative humidity, air speed, depending on the ability of the human body to acclimatize at different times of the year, the nature of the clothes, the intensity of the work done and the nature of the heat in the working room.

The microclimate parameters in the production premises are controlled by various control and measuring devices. To measure the air temperature in industrial premises, use mercury (for measuring the temperature above 0 ° C) and alcohol (for measuring the temperature below 0 ° C) thermometers. For example, you can buy a thermometer TM. There are other devices for measuring air temperature, for example, thermocouples. If constant temperature change is required over time, devices called thermographs are used.

Optimal microclimatic conditions are a combination of microclimate parameters, which, with prolonged and systematic exposure to humans, provides a feeling of thermal comfort and creates the prerequisites for high performance. Admissible microclimatic conditions are such combinations of parameters of a microclimate which at long and regular influence on the person can cause pressure of reactions of thermoregulation and which do not go beyond the limits of physiological adaptive possibilities.

At the same time, there are no abnormalities in the state of health, there are no uncomfortable warm sensations, which worsen the well-being and decrease in working capacity. The optimal microclimate parameters in the production premises are provided by air conditioning systems, and the permissible parameters - by conventional ventilation and heating systems.

Types of ventilation of premises. Ventilation of premises is achieved by removing heated or polluted air from them and by supplying clean outside air.

Since in this chapter we are considering ventilation systems designed to provide the specified meteorological conditions, consider a general exchange ventilation that performs air changes throughout the room. Other types of ventilation are discussed below. General ventilation is designed to maintain the required parameters of the air environment throughout the room. For effective operation of the general ventilation system, while maintaining the required microclimate parameters, the amount of air entering the room (Lp) should be practically equal to the amount of air removed from it (LWe).

With the simultaneous separation of moisture vapor and excess heat in the production room, calculations are carried out according to formulas (4.1) and (4.2) and the most obtained value is used as the desired result. In air heating systems, air heated in special installations (air heaters) is used. Combined heating systems use the heating systems discussed above as elements. The microclimate parameters in the production premises are controlled by various control and measuring devices.

To measure the air temperature in industrial premises, use mercury (for measuring the temperature above 0 ° C) and alcohol (for measuring the temperature below 0 ° C) thermometers. If constant temperature change is required over time, devices called thermographs are used. For example, the domestic device-thermograph type M-16 - registers the temperature change for a certain period (day or week). There are other devices for measuring air temperature, for example, thermocouples. To measure the relative humidity of the air, instruments called psychrometers and hygrometers are used, and a hygrograph serves to record the change of this parameter in time. The simplest psychrometer is a device consisting of dry and wet thermometers. In a damp thermometer, the tank is wrapped with a hygroscopic cloth, the end of which is lowered into a glass with distilled water. A dry thermometer shows the temperature of the air in the production room, and the wet one - a lower temperature, because the water evaporating from the surface of the wet cloth takes away the heat from the thermometer tank. There are special transferable psychrometric tables that allow you to determine the relative humidity of the air in the room by the temperatures of dry and wet thermometers.

Natural ventilation. With natural ventilation, air moves due to the difference in temperatures in the room and outside air, and also as a result of wind pressure (wind action). Methods of natural ventilation: infiltration, ventilation, aeration, using deflectors. In the case of unorganized natural ventilation, the air exchange is effected by the displacement of the internal heat air by the external cold air through windows, windows, transoms and doors. Organized natural ventilation, or aeration, provides air exchange in pre-calculated volumes and is regulated in accordance with meteorological conditions.

Channelless aeration is carried out by means of openings in the walls and ceiling and is recommended in rooms of large volume with significant excess of heat. To obtain a calculated air exchange, the ventilation openings in the walls, as well as in the roof of the building (aeration lanterns) are equipped with transoms that open and close from the floor of the room. Manipulating transoms, it is possible to regulate air exchange when changing the outside air temperature or wind speed. The area of the ventilation openings and lanterns is calculated depending on the required air exchange.

In production facilities of small volume, as well as in premises located in multi-storey industrial buildings, channel aeration is used, in which contaminated air is removed through ventilation ducts in the walls. To strengthen the hood at the outlet of the channels on the roof of the building, deflectors are installed - devices that create traction when blown by the wind. At the same time, the flow of wind, striking against the deflector and flowing around it, creates a vacuum around most of its perimeter, providing air sucking from the channel.

The most common types of deflectors are the TsAGI type (Figure 4.2), which represent a cylindrical shell reinforced above the exhaust pipe. To improve the intake of air by wind pressure, the pipe ends in a smooth expansion - the diffuser. To prevent rain from entering the deflector there is a cover.

Local ventilation system. Local supply ventilation serves to create the required air environment in a limited area of the production premises. To the installations of local supply ventilation are air showers, oases and veils. Air strangulation is used in hot shops at workplaces characterized by exposure to radiant heat of 300 kcal / h * m2 and more. The air shower is a working air stream. The blowing speed is from 1 to 3.5 m / s, depending on the intensity of irradiation. The action of the air shower is based on increasing the heat output of a person when the speed of the blowing air increases. Airborne aerial installations are stationary when air is directed to a fixed workplace through a system of air ducts with supply nozzles, and mobile ones using an axial fan.

The effectiveness of such choking aggregates is enhanced by spraying water in a jet of air. Devices of local exhaust ventilation are made in the form of shelters or local suction. The amount of air L (m3 / h) to be removed from shelters and suction is determined by the formula Z = Fv3600, where F - the area of openings, openings, leaks, through which air is sucked, m2; v - air velocity in these apertures and openings, the value of which depends on the type of the exhaust device and the nature of the harmful substances, m / s.

Harmful substances are divided into 4 classes according to the degree of danger:

1. Extremely dangerous
2. High danger.
3. An acceptable risk.
4. Little danger.

Often, the source of harmful substances - a bath, an oven, a welding table, etc. - is covered with an umbrella, under which the worker is located, which is completely unacceptable, because through the breathing zone in this case all harmful substances pass. Naturally, the correct design of the suction will be such that the flow of air passes through the worker.

Permissible standards for the concentration of harmful substances in the work area

The study of the biological effect of chemicals on humans shows that their harmful effects always begin with a certain threshold concentration. To quantify the harmful effect on humans of a chemical in industrial toxicology, indicators characterizing the degree of its toxicity are used. Average lethal concentration in air LC50 is the concentration of a substance that causes the death of 50% of animals with a two-four-hour inhalation effect on mice or rats. The average lethal dose of LSD0 is the dose of the substance that causes the death of 50% of the animals upon a single injection into the stomach.

Mechanical ventilation. Artificial (mechanical) ventilation eliminates the shortcomings of natural ventilation. In case of mechanical ventilation, the air exchange is carried out due to the air pressure created by the fans (axial and centrifugal); air in winter is heated, in the summer - it is cooled and furthermore it is cleaned of impurities (dust and harmful vapors and gases).

Mechanical ventilation can be supply, exhaust, supply and exhaust, and in the place of action - general exchange and local.

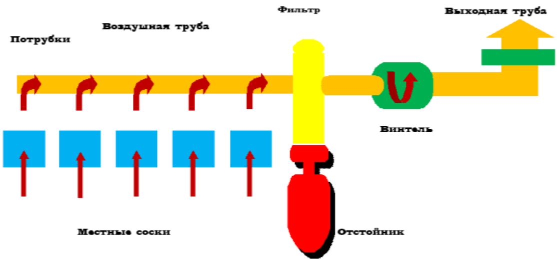


Fig. 1.1. Pulled ventilation

With the supply air system, air is drawn from outside with the help of a fan through the air heater, where the air is heated and, if necessary, is moistened, and then fed into the room. The amount of air supplied is regulated by valves or flaps installed in the branches. Contaminated air exits through doors, windows, lanterns and crevices untreated.

The full shelter of machines and mechanisms that highlight harmfulness is the most perfect and economical way to prevent them from entering the air of the room. It is important to develop the technological

equipment in the design stage in such a way that such ventilation devices are organically included in the overall design, without interfering with the technological process and at the same time completely solving the sanitary and hygienic tasks.
With intensive dust emissions, for example, in the preparation of mixtures in the foundry industry, the most rational shelter is the dust suction casing, which completely closes the source of dust formation.

Protective-dust-collecting casings are equipped with machines, where the processing of materials is accompanied by dusting and flying off of large particles, which can cause injury (Fig. 15, a). These are grinding, grinding, polishing, grinding machines for metal, woodworking machines, etc. Local ventilation is designed to remove harmful substances from the zone of their release or to normalize the microclimate parameters in the workplace. Local ventilation is an exhaust and supply system.

Noise and vibration

Vibration is the vibrational motion of a material point or a mechanical system. The causes of vibration: unbalanced masses with reciprocating motion (stamping), unbalanced masses in the course of rotational motion (electric motor), electromagnetic oscillations.

Vibration characteristics:

1. Frequency, Hz

The frequency f <0,7 Hz does not cause vibration (pumping). The natural frequency of the internal organs of man is 6-9 Hz (each organ has its own frequency of oscillation to exclude resonance)

2. Amplitude of vibration velocity, m / s;

3. Amplitude of vibration acceleration, m / s2;

4. Logarithmic level of vibration velocity, dB

$$L_V = 20 \lg \frac{V}{V_0},$$

where V is the velocity created by the source of vibration;

Vo = m / s - threshold of sensation of vibration. Effects of vibration on humans. Occupational disease - vibrobolezn. It manifests itself in the violation of the central and peripheral nervous system. For example, when working with a hand mechanism that creates vibration, a person can have certain changes in his state of health: loss of sensitivity and trembling of hands; the defeat of the central nervous system is usually expressed in the appearance of a headache, a decrease in working capacity.

Vibration normalization. Vibration is subdivided:

1. By the method of transmission per person: general (transmitted to the whole organism) - machine, local (transferred to separate parts of the body, more often by hand) – drill;

2. In the direction of impact: Axis X, Axis Y, Z axis.

3. For general vibration, depending on the source of education: transport (truck, bus driver), transport

technology (floor-guild transport, crane operator), technological.

4. According to the time characteristic: constant and unstable.

Vibration is normalized depending on the frequency in terms of the rms value of vibration velocity, m / s, vibration acceleration, m / s2, or their logarithmic levels, dB. Methods to combat vibration.

1. Reduction of vibration in the source (application of technological processes without vibration).

2. Mismatch of the vibrational frequency with the resonance frequency (when designing, the natural frequency must not coincide with the frequency of the forced oscillations). Changing the natural frequency by varying the value of the mass of structures and introducing ribs of rigidity.

3. Vibrodemification - the transformation of the mechanical energy of oscillations into thermal energy due to the increase in the forces of internal or surface friction. Internal friction - each material has a

characteristic - the coefficient of vibration loss. It is used to replace some materials with others with a large coefficient of vibration loss. Steel - 0.005; Cast iron - 0.01; Color alloys - up to 0,1; Rubber - up to 0,5.

Surface friction - application on the vibrating surface of a layer of elastic-viscous materials with a high coefficient of vibration loss.

4. Vibration damping:

- passive (increase in the weight of the foundation)

- active (adding a mass with the same modulo value of the frequency of own and forced oscillations, which are in antiphase at the same time)

5. Vibration isolation - reduction of vibration in the way of its propagation due to the use of elastic elements (springs, rubber, etc.).

KP - the transmission coefficient shows how much of the vibrational energy is transferred from the source of vibration to the base on which the person stands.

$$K_{\Pi} = \frac{1}{\left(\frac{f}{f_0}\right)^2 - 1} < 1$$

where f is the forced frequency, Hz; f o is the natural frequency, Hz.

6. Use of PPE. When exposed to the hands, gloves are used. When transferring the turn of the leg - special shoes, for example, with a thick rubber sole.

7. Reduction of exposure time (permissible value in GOST - 8 hours).

Protection from noise. Sound - mechanical vibrations of the air, perceived by the organs of hearing. Noise is a set of sounds that adversely affects human health. Physical characteristics of noise: Frequency f, Hz

Each frequency range is divided into octaves in such a way that the upper boundary frequency is twice the lower boundary frequency: fB = 2fH. The characteristic of an octave is the mean geometric frequency:.

Sound pressure P, Па. Logarithmic sound pressure level Lp, dB:

$$L_P = 20 \cdot \lg \frac{P}{P_0}, \text{ дБ}$$

where P is the sound pressure generated by the source; Po = Pa - threshold of audibility at f = 1000 Hz. The usual conversation is 50 dB. The machines are 70-110 dB. The jet plane (takeoff) is 140 dB. The rupture of the eardrum is 145 dB. Increasing the noise level by 5 dB a person seems to increase the volume by 2 times. Classification of noise: According to the source of education (mechanical, aerodynamic, hydrodynamic, electromagnetic).

2. Depending on the frequency spectrum (LF, MF, HF).

3. By the nature of the spectrum (tonal (noise within one octave), broadband (in different octaves)).

4. Time characteristics. Permanent (the working day changes less than 5 dB).

Unstable: oscillating (continuously changing in time), intermittent (sound pause for more than one second), impulsive (sound pause is less than one second). From a physical point of view, sound is mechanical oscillations that propagate in the form of waves in a gaseous, liquid or solid medium. Sound waves arise when a stationary state of a medium is disturbed by the action of some disturbing force on it. At the same time, noise is considered to be any undesirable for a person sound. Thus, sound waves can carry information useful to the operator, for example, about the progress of the technological process, and may have a negative (and sometimes harmful) effect.

The source of sound vibrations is usually a vibrating body, which transforms some form of energy into vibrations. This process can be a mechanical action on a solid body, the communication of oscillations to an air column under the action of a compressed air jet (whistle or pipe), or electromagnetic action on a steel membrane (electromechanical source, for example, a telephone) or a crystal (piezoelectric source). Sound vibrations are characterized by the following physical parameters.

The speed of propagation of a sound wave depends on the characteristics of the medium. Under normal atmospheric conditions, the speed of sound in the air is - 344 m / s. The speed of sound in water is about 1500 m / s, in rubber 30 m / s, in brick 2500 - 3000 m / s, and in metals from 4000 to 6000 m / s. The space in which sound waves propagate is called the sound field. The pressure and velocity of air particles at each point of the sound field vary with time. Sound waves excite the vibrations of particles of the air medium, as a result of which the atmospheric pressure changes. This atmospheric pressure, in comparison with the pressure existing in an undisturbed medium, is called the sound pressure (p) and is measured in Pascals (Pa).

The frequency of sound is determined by the number of oscillations of sound pressure per second and measured in hertz. By frequency, sound vibrations are divided into three ranges; infrasonic with oscillation frequency less than 20 Hz, sound - from 20 to 20,000 Hz and ultrasonic - more than 20,000 Hz. The audio range is divided into low-frequency - up to 400 Hz, mid-range - from 400 to 1000 Hz and high-frequency - over 1000 Hz. When the sound wave propagates, sound energy is transferred. The average flow of sound energy per unit of time per unit of surface perpendicular to the direction of wave propagation is called the intensity, or the strength of sound at a given point.

The intensity of sound can not be directly measured by any of the known methods. Existing instruments allow you to measure only the sound pressure by its impact on the microphone. Having the value of sound pressure, the intensity of sound can be determined by calculation. The perception of sound by a hearing aid is determined not so much by the absolute values of sound pressure and sound intensity as by the logarithm of their ratio to the threshold values. To quantify the concept of the level defined in decibels The use of the logarithmic scale was suggested by the scientist Alexander Graham Bell (1847-1922), one of the inventors of the phone. (dB). Using a decibel scale is very convenient, since the entire range of audible sounds from the threshold of audibility to pain sensation is 140 dB. The magnitude of the sound intensity level is used in acoustic calculations, and the sound pressure level is used for measuring noise and assessing its effect on a person. In addition, with a large number of identical sources, eliminating only a few of them will hardly weaken the total noise. If the workplace gets noise from sources of different intensity, then first of all it is necessary to fight with noise from the most powerful. The area of audible sounds is limited not only by a certain frequency range (20-20000 Hz), but also by certain limiting values of sound pressures. In Fig. 6.1. Fig.

The area of auditory perception is represented by the area of auditory perception accessible to the normal ear. The lower curve represents the threshold of audibility, it corresponds to the weakest sounds. The upper curve corresponds to loud sounds, the perception of which causes a painful sensation. The thresholds of audibility and pain threshold limit the area of hearing. The sounds perceived by man are in this area. As can be seen from the figure, the threshold of audibility and the pain threshold significantly change with the frequency change. The ear is most sensitive to frequencies of 5-10 kHz. With increasing and decreasing frequency, the threshold value of audibility increases, especially at low frequencies. For this reason, high-frequency sounds are more unpleasant for humans than low-frequency sounds (at the same sound pressure levels). When normalizing and to assess the impact of noise on the human body using the spectral characteristics of noise. Similarly come with 1/3-octave frequency bands. The preferred values of the mean geometric frequencies that should be used in acoustic studies are established in GOST 12090 "Frequencies for acoustic measurements. Preferred series. " In accordance with the frequency intervals used, the concepts of octave and a third of octave levels of sound pressure are introduced. To estimate the overall sound pressure level, a frequency correction of the sound level meter bandwidth is introduced. The use of such a correction frequency is caused by the fact that the human ear has unequal sensitivity to sounds of different frequencies. Therefore, for a more objective evaluation of production noise, the frequency response of the measuring devices is corrected in accordance with the features of the auditory perception. Impact of noise on a person.

First of all, noise affects the nervous and cardiovascular systems, the organs of hearing. Noise is a general biological irritant and under certain conditions can affect all organs and systems of the body. Depending on the level and nature of noise, its duration, as well as individual characteristics of a person, the consequences of noise exposure can be very different.

Intensive noise with daily exposure leads to the emergence of occupational disease - hearing loss. The main symptom of hearing loss is a gradual loss of hearing. Initially, it occurs in the high frequency region, then the hearing loss extends to lower frequencies, which determine the ability to perceive speech. At very high sound pressure, the hearing aid may be damaged, up to the eardrum rupture.

In addition to direct impact on the hearing organs, noise affects various parts of the brain, disrupting the normal processes of higher nervous activity. This impact occurs even earlier than changes in the organ of hearing. Typical are complaints of increased fatigue, general weakness, irritability, apathy, memory loss, sweating, etc. Under the influence of noise, changes occur in the human visual organs (the stability of clear vision and visual acuity decreases, sensitivity to different colors changes, etc.) and the vestibular apparatus; the functions of the gastrointestinal tract are disrupted; increased intracranial pressure, etc.

Noise, especially intermittent, impulsive, worsens the accuracy of performing work operations, makes it difficult to receive and perceive information. As a result of the adverse impact of noise on the worker, a decrease in labor productivity occurs, the amount of marriage increases, and preconditions for the occurrence of accidents are created. Approximately, the effect of noise, depending on its level, can be characterized as follows. The noise level of 35-50 dB has mainly a psychological effect. However, with prolonged exposure, it can cause sleep disturbance, fatigue, and decreased performance.

Noise level 50-65 dB causes irritation, but its consequences are also only psychological (with prolonged exposure, changes in the autonomic nervous system are possible). Particularly negative is the effect of low-intensity noise on mental work. In addition, the psychological impact of noise depends on the individual attitude towards it. So, the noise produced by the person does not bother him, while a small foreign noise can cause a strong irritation. At a noise level of 65-90 dB, its physiological effect is possible. Pulse and blood pressure increase, the vessels narrow, which reduces the supply of the body with blood, and the person gets tired faster.

There may be a decrease in the threshold of hearing, stress, an increase in skin conduction, a violation of the motility of the gastrointestinal tract. The impact of noise above 90 dB leads to disturbances in the functioning of the hearing system, its effect on the circulatory system is strengthened. With this intensity, the activity of the stomach and intestines worsens, nausea, headache and tinnitus appear. A serious sign of hearing impairment is the limited perception of individual elements of colloquial speech. To avoid hearing loss, it is necessary to recognize its violation long before the limitations in speech intelligibility are revealed, for with the progressing stage of hearing impairment, medical assistance is almost impossible. To study the hearing status of people working in noisy shops, it is necessary to conduct regular audiometric measurements, and as soon as any distortions in the threshold of audibility are revealed, take appropriate measures.

With a noise level of 120 dB and above (pain threshold), it can mechanically affect the hearing organs

- eardrums burst, connections between individual parts of the inner ear are broken. As a result, there may be a complete loss of hearing. Noise level above 120 dB has a mechanical effect not only on the hearing organs, but also on the whole organism. Sound, penetrating through the skin, causes mechanical vibration of the tissues, resulting in the destruction of nerve cells, ruptures of small blood vessels, etc. Physiological impact on the human body can also have sounds, the frequency of which lies beyond the perception of the organs of hearing, i.e. infra- and ultrasound.

Noise regulation: For constant noise, the limiting spectrum is normalized - the set of permissible sound pressure levels as a function of frequency. Unstable noise - by the sound level in dB (sums any frequencies). Methods to combat noise: Reduction of noise in the source (replacement of shock processes with unstressed ones, replacement of manual welding with automatic, timely repair, replacement of metal parts with plastic ones).

Changing the direction of noise. Rational planning of shops. Acoustic means of protection. Sound insulation (enclosing structure, reflecting most of the sound energy) dB where m is the mass of 1 m2 of the partition, kg; f is the frequency.

Sound absorption (conversion of sound energy into thermal energy due to viscous friction in capillaries of porous materials), dB. Sound absorption (conversion of sound energy into thermal energy due to viscous friction in capillaries of porous materials), dB, where is the sound absorption coefficient, which depends on the material and sound frequency. Personal protective equipment: liner (reduces noise by 5 to 20 dB), headphones (by 34-45 dB), helmet (applies if the noise level is over 120 dB), noise-resistant costumes (if the noise level is over 135 dB). Industrial lighting Light is the visible part of the spectrum of electromagnetic radiation with a wavelength of 380-780 nm.

Lighting technical values. The main lighting parameters: quantitative (sufficient lighting) and high-quality (comfort). Main quantitative values of illumination:

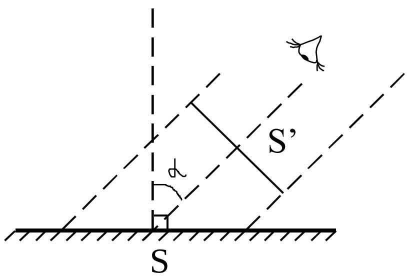
- the light flux Ф (F), лм (lumen) - part of the radiant energy, which is perceived by the eye as light; - light intensity J, cd (candela) - spatial density of the light flux

$$J = \frac{F}{\Psi},$$

where is the solid angle;

- illumination E, lux (lux) - surface density of the light flux $E = \frac{F}{S}$;

- brightness of the surface L, cd / m2 - the intensity of light reflected from a unit of surface area in a given direction;



$$L = \frac{J}{S} = \frac{J}{S \cdot \cos\alpha}$$

- coefficient of reflection, ρ, per unit,%.

Main quality values:

- Spectral composition;

- coefficient of pulsation.

The coefficient of ripple (Kp) is an indicator of the relative depth of variation of illumination in time

$$K_{п} = \frac{E_{max} - E_{min}}{2E_{cp}} \times 100\%$$

Measures to reduce the ripple factor: increasing the frequency, connecting luminaires to different phases, changing the solid angle (using capacitors). Stroboscopic effect - the effect of visual distortion of the movement, which occurs when the frequency of light pulsation coincides with the frequency of movement of the object (it seems that the object is immobile).

The following requirements are imposed on production lighting: sufficiency, uniformity, shadow should not be in sight, especially moving, directivity, simplicity, reliability, cheapness, should not create additional dangerous and harmful factors.

Fixtures used for lighting are: direct light, reflected light, scattered light. By the degree of openness: open (unprotected), closed (explosion-proof, explosion-proof, dust-proof).

Classification of industrial lighting. Industrial lighting can be of three types: natural, artificial and combined. Natural light is upper and side. Artificial - general uniform or localized and combined (general and local).

In the normalization of illumination, the size of the object of discrimination (mm) is the determining factor, according to which the discharge of visual work is determined. The natural illumination is normalized by the coefficient of natural illumination. For side lighting, the minimum value is normalized, and for the upper and combined - the average. The smallest artificial illumination on working surfaces in production premises is established taking into account the background, the contrast of the object with the background, the lamps used and the type of lighting. In terms of function, the lighting is divided into: working - lighting during working hours, duty - lighting outside working hours, security - lighting the boundaries of the protected area, evacuation - "exit", emergency - for life support activities. The following harmful and dangerous production factors are associated with illumination:

• its excessive or insufficient value, pulsation;

• the discrepancy between the spectral composition of light and the conditions of operation and distortion of the color transmission of objects;

• uneven lighting of the workplace;

• Excessive or insufficient contrast of the subject under consideration with the background;

• Blinding by direct contact with the eyes;

• possibility of manifestation of stroboscopic effect, etc.

An important quantitative characteristic of lighting is the illumination of the working surfaces. It is the surface density of the light flux at a given point. The unit of illumination is lux (lux), equal to the illumination created by the luminous flux of 1 lm (lumen), evenly distributed over an area of 1 m2. Depending on the source, natural, artificial and combined lighting is distinguished. Natural light is provided by the sun and the diffused light of the sky. Artificial - incandescent and gas-discharge lamps. Combined lighting is a combination of natural and artificial lighting.

The natural lighting of the production premises is subdivided into the side (through the side windows), the upper (through the upper light and glass roofs), combined (a combination of top and side lighting). By design, artificial lighting is divided into general and combined. In general lighting, the fixtures are located in the upper part of the room, creating a uniform uniform illumination of the entire workshop or a separate section.

In the latter case, it is called local illumination. With combined lighting in addition to the general add local lighting, concentrating the light stream directly at the workplace. The use of one local lighting is not allowed. By designation, artificial lighting is subdivided into working, emergency, evacuation, security, duty. Work lighting is designed to create normal vision conditions at workplaces while performing work processes.

Emergency lighting is arranged in rooms where it is necessary to continue working with sudden disconnection of working lights, and also in cases where such a trip can cause a long process breakdown, explosion, fire, etc. Emergency lighting fixtures are connected to an autonomous power source. Evacuation lighting is provided on the evacuation routes of people in case of switching off the working illumination. Security lighting is arranged along the boundaries of the territories guarded at night. Duty lighting is provided for lighting workplaces, workshops during non-working hours.

Lighting jobs should meet the conditions and nature of the work, it should be optimal in magnitude, and its spectrum should be as close to the day (solar), best suited to human physiology. Excessively high illumination, as well as insufficient illumination, causes rapid eye fatigue, reduced visibility. Lighting should be fairly uniform in area, since when you look from less illuminated to brightly lit surfaces and vice versa, the visual acuity decreases for a certain period of time associated with eye re-adaptation.

In connection with this, SPI 23-05-95 [1] limits the unevenness of illumination at workplaces (the ratio of maximum illumination to minimum) from 1.5 to 3 for various types of work. For the same reason, in combined artificial lighting, the share of total lighting should be at least 10%. For a quick and clear distinction of objects and their details, there must be some, but not excessive, contrast between the brightness of the subjects and the background. The amount of light should not pulsate in time. The light flux in the filament lamps forms an electrically heated tungsten filament enclosed in a glass flask with evacuated air (vacuum tubes) or filled with gas: nitrogen, krypton, xenon, argon (gas-filled lamps). Incandescent lamps are simple in design and maintenance, they are cheap to manufacture, but have a low service life (up to 2500 h), a light output (7-20 lm / W), and therefore are uneconomical. In addition, their spectrum is dominated by yellow and red rays.

Gas-discharge lamps form a light flux as a result of the glow of inert gases, metal vapors and their mixtures enclosed in glass containers, under the influence of an electric current. Their advantages over incandescent lamps: high luminous efficiency (40-110 lm / W), long service life (up to 8000-15000 h), the possibility of obtaining a light flux in almost any part of the spectrum. Disadvantages - distortion of color rendition in some types of lamps, prolonged combustion (sometimes up to 10-15 minutes); high ignition voltage (more working), in connection with which it is necessary to use complex starting devices; danger of stroboscopic effect.

Gas discharge lamps have almost no-inertia radiation, which leads to the appearance of pulsation of the light flux with a frequency equal to the frequency of the industrial current. This distorts the perception of moving, rotating parts. In the light of gas-discharge lamps, they can appear stationary, moving at a different speed, in the opposite direction. This phenomenon was called the stroboscopic effect. It is associated with a high risk of injury and can be reduced by switching on lamps at various phases of the network or by using special switching circuits. SNiP 23-05-95 * allows pulsation no more than 10-20%, depending on the discharge level and type of lighting.

Gas discharge lamps and nowadays everywhere replace incandescent lamps. The use of general-purpose incandescent lamps for lighting is limited by Federal Law No. 261-FZ of 23.11.2009 "On Energy Saving and on Improving Energy Efficiency and on Amending Certain Legislative Acts of Uzbekistan." Since January 1, 2011, it is not allowed to use incandescent lamps with a power of 100 W or more for illumination. The use of halogen incandescent lamps for general lighting is allowed only for architectural and artistic requirements.

Norms of production lighting are established SNiP-23-05-95 * for artificial, natural and combined lighting in eight categories of work, characterized by their accuracy and the smallest size of the object under consideration.

Norms for artificial lighting are installed in lux, and on natural - in the value of the coefficient of natural illumination (KEO), expressed in percents and showing how much the natural illumination of the working surface inside the room (EVN) is from the simultaneous horizontal illumination in the open area from the scattered light of all the firmament (Enar):

The norms of artificial illumination are given for gas-discharge lamps. The illumination of the working surface, created by the lamps of general lighting in the combined system, must be at least 10% of the rated for combined lighting. At the same time, the illumination should be not less than 200 lux. To create illumination from general lighting in a combined system of more than 1000 lux is allowed only if there are justifications.The ratio of maximum illumination to minimum under artificial illumination should not exceed for works I-III in the case of fluorescent lamps 1, 3, with other light sources 1.5, for discharges IV-VII, 1.5 and 2.0, respectively.

Most agricultural processes refer to works of medium, small and rough accuracy, where hygienic norms of artificial illumination do not exceed 300 lux, and natural - 1%. Thus, illumination in 300 lx under the general lighting system is envisaged in repair shops for engines, units, machining of parts, repair of electrical equipment, power systems; 200 lx - in forging, welding, tin, copper work, carpentry, tire repair, maintenance; 150 lux - on the sections of the sink, in the inspection ditches; 75 lux - at the points of daily maintenance of machines, tool depots; 30 lx - in warehouses of fuel-lubricating materials, etc.

The illumination of the working bodies of tractors and agricultural machinery in accordance with "GOST 12.2.019-2005 SSBT. Tractors and machines self-propelled agricultural. The general safety requirements" should be 20 lx, illumination of the site ahead of them at a distance of 10 m - 15 lx, at a distance of 30 m - 5 lux, illumination of unloading zones (loading) of technological product - 15 lux. Sanitary standards do not prohibit the increase of workplace illumination above the standardized values, if this is appropriate under the conditions of work. In the executive offices, in the offices of SanPiN 2.2.1 / 2.1.1.1278-03, it establishes side natural illumination - 1%, artificial combined lighting - 400 lux, one general - 300 lux. Accordingly, for reading rooms, typewriting bureaus, scientific and technical laboratories, facilities for working with a PC, 1.2%, 500 and 400 lux are installed; in the design drawing rooms - 1.5%; 600 and 500 lux respectively. The illumination from the emergency lighting fixtures should be at least 5% of the working light and be at least

2 lx inside buildings and 1 lx outside, evacuation - 0.5 lx in rooms on the floor and 0.2 lx on the outside, security luminary - 0.5 lx at the level of the earth. Normalization of illumination. Normalization of industrial lighting is carried out in accordance with SNiP 23-05-95 "Natural and artificial lighting. Norms of designing ». There is a separate normalization of natural, artificial and combined lighting. Artificial lighting is normalized depending on the characteristics of visual work, the discharge of visual work, the sub-division of visual work and the lighting system. To create the best conditions for a vision in the workplace, jobs must be properly lit. The required level of illumination is primarily determined by the accuracy of the work performed and the degree of danger of injury.

To characterize the accuracy of the works performed, the concept of the object of discrimination is introduced-this is the smallest size of the object under consideration, which must be distinguished in the process of work. For example, when drawing jobs, the object of discrimination is the thickness of the thinnest line in the drawing, when working with printed documentation - the smallest size in the text has a dot, etc.

Of great importance is the nature of the background, on which the objects are examined, that is, the surface directly adjacent to the object of discrimination, and the contrast of the object with the background, which is determined by the ratio of the brightness of the object and background.

Characteristics of visual work (accuracy of work) is determined by the size of the minimum object size of discrimination in mm.

The sub-bitumen of visual work depends on the combination of the contrast of the object of discrimination with the background and the characteristics of the background (a, b, c, d). The contrast is large, medium, small, background - light, $\rho > 0.4$; average, $0.2 < \rho < 0.4$; dark, $\rho < 0.2$.

The normalized parameters of artificial lighting are: the amount of illumination in lux and the combination of the indicator of glare and the ripple coefficient. Natural light is normalized by the coefficient of natural light,%, depending on the characteristics of visual work, the discharge of visual work and the lighting system: Outdoor illumination is the illumination of a completely open sky under a 100-point cloud cover.

Natural lighting should be at every workplace. Without natural lighting allowed: warehouses, locker rooms, corridors, medical points, that is, support facilities.

The quantitative indicators of industrial lighting include:

- radiant flux,
- light flow,
- the power of light,
- Brightness,
- Illumination.

Radiant flux (Φ) is the total power of electromagnetic radiation to the optical wavelength range. The unit of measurement is / W /. The visual sensation experienced by a person when a radiant stream hits the retina depends not only on the radiation power, but also on the wavelength. Radiation of different wavelengths cause a different color sensation in color and intensity. Luminous Flux (F) is the power of radiant energy, estimated by the light sensation it produces on the human eye. Unit of measurement (LM). The intensity of light (I) is the spatial density of the light flux where is the solid angle in steradians.

The unit of measurement is candela (CD), which is the main luminous value to which there is a national light standard. Candela - the force of light from the area of the platinum plate equal to 1/600000 m2 at the solidification temperature of platinum (2042 K) and pressure 101325 Pa. Illuminance (E) is the density of the light flux on the illuminated surface where S is the surface area. The unit of measurement is lux (LC). The brightness of the surface (L) is the ratio of the light intensity dF of the emitted surface element dS at an angle to the projection of this element onto a plane perpendicular to the line of sight.

Brilliance - excessive brightness - the cause of fatigue and reduced efficiency. The nature of visual work is determined by a combination of such parameters as the size of the object of discrimination, the background, the contrast of the object with the background. The object of discrimination is the smallest size of the object under consideration, a separate part of it, which must be distinguished in the course of work (for example, when working with instruments - the thickness of the scale calibration line, in drawing jobs - the thickness of the thinnest line in the drawing). The background is the surface immediately adjacent to the object of discrimination on which it is viewed. The background is characterized by a reflection coefficient, by which is meant the ability of the surface to reflect the light flux incident on it.

Depending on the value of the reflection coefficient, the background can be:

• - light (p> 0,4);

• - medium (p = 0.2 t 0.4);

• - dark (p <0.2 ').

The contrast of the object of discrimination with the background is determined from expression where B, and B0 are the brightness of the background and the object of discrimination, respectively. The contrast can be:

• - large (K> 0.5);

• - the average (K = 0.2 ^ 0.5);

• - small (K <0.2).

2. System and types of industrial lighting

Industrial lighting systems can be classified depending on the light source and on the design (Fig. 1). Sources of light Lamps incandescent (LN). The advantages of LN: cheapness, simplicity, lack of pulsation, insensitivity to voltage reduction, less sensitive to temperature changes, do not create radio interference, small size, recycling. Disadvantages LN:

short service life, low light output. Gas discharge lamps. Advantages: high luminous efficiency (100 lm / W), high service life, the possibility of obtaining any spectrum. Disadvantages: pulsation of the light flux, noise, complexity in operation, reduction of the luminous flux at the end of the service life, large dimensions, heating time up to 15 minutes, in one lamp up to 0.1 gm ppm.

Protection against ionizing radiation and electromagnetic fields Electromagnetic waves are only partially absorbed by the tissues of a biological object, so the biological effect depends on the physical parameters of the EMF of radio frequencies: the wavelength (frequency of oscillations), the intensity and mode of radiation (continuous, intermittent, pulse-modulated), the duration and nature of the body's irradiation (permanent, intermittent) , and also from the area of the irradiated surface and the anatomical structure of the organ or tissue.

The degree of energy absorption by tissues depends on their ability to reflect it at the interface, determined by the water content in the tissues and other features of them. When EMF is applied to a biological object, the electromagnetic energy of the external field is converted into thermal energy, which is accompanied by an increase in body temperature or local selective heating of tissues, organs, cells, especially with poor thermoregulation (lens, vitreous, testicles, etc.). The thermal effect depends on the intensity of the radiation exposure.

Characteristic of the electromagnetic field

The electromagnetic field is characterized by the electric field strength vectors E (W / m) and magnetic II (A / m) fields. The vectors E and H of the traveling electromagnetic wave are always mutually perpendicular. When propagating in a conducting medium, they are related by the relation

$$E = H\sqrt{\frac{\varpi\mu}{\gamma}}e^{-kz},$$

where ω is the circular frequency of electromagnetic oscillations; y is the conductivity of the screen material; μ is the magnetic permeability of this substance; k is the attenuation coefficient; z is the distance from the input plane of the screen to the point under consideration. When propagating in vacuum or air, E = 377 N. The propagation of electromagnetic waves is associated with the transfer of energy to the field. The energy flux density vector (intensity) of electromagnetic waves J (W / m2) is called the Umov-Poynting vector and is determined by the formula

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According to the theory of electromagnetic field, the space near the source of alternating electric or magnetic fields is divided into two zones: the near zone, or the induction zone, which is located

$$R \leq \frac{\lambda}{2\pi} \cong \frac{\lambda}{6}$$

at a distance is the wavelength determined from the ratio λ = c / f, where c is the speed of propagation of electromagnetic disturbances (for vacuum or air the speed of light), f is the frequency of electromagnetic oscillations, and the radiation zone that is at a distance R> λ / 6. In the induction zone (near field), the traveling electromagnetic wave has not yet formed and the electric and magnetic fields can be considered independent of each other, therefore the normalization in this zone is carried out both in the electric and magnetic components of the electromagnetic field.

In the radiation zone (wave zone), the field is characterized by a traveling electromagnetic wave, the most important parameter of which is the power flux density. The normalization in this zone is based on the intensity, which is inversely proportional to the square of the distance to the point source:

$$J = \frac{P_{ист}}{4\pi R^2},$$

where G is the antenna gain, determined from its calculation.

Influence of alternating electromagnetic fields on man. The effect of electromagnetic fields on a person depends on the strengths of the electric and magnetic fields, the intensity of the energy flow, the frequency of oscillations, the localization of the irradiation on the surface of the body and the individual characteristics of the organism. The mechanism of this effect is that in the electric field the atoms and molecules of which the human body consists are polarized, and the polar molecules (for example, water), in addition, are oriented along the direction of propagation of the electromagnetic field. In electrolytes, which are the liquid components of tissues, blood, intercellular fluid, etc., after applying an external field, ion currents appear. The alternating electric field causes heating of human body tissues both due to the variable polarization of dielectrics, and due to the appearance of conduction currents.

The thermal effect is a consequence of the absorption of the energy of the electromagnetic field. In addition, there is a reflection of electromagnetic waves from the surface of the human body due to a change in this boundary of the wave resistance of the medium. Absorption of energy and the emergence of ion currents is accompanied by a specific effect on biological tissues, as the fine structure of electrical potentials and fluid circulation in cells and internal organs is disturbed.

An alternating magnetic field leads to a change in the orientation of the magnetic moments of atoms and molecules. This effect is weaker than that caused by the external electric field, but it is also not indifferent to the organism.

The greater the field strength and the longer the exposure time, the more pronounced the effects are. An increase in the frequency of oscillations leads to an increase in the conductivity of the body, the fraction of absorbed energy, and a decrease in the penetration depth of the waves. Experiments have shown that radiation with wavelengths shorter than 10 cm is largely absorbed by the skin; radiation with wavelengths of 10-30 cm is absorbed to a lesser degree (by 30-40%), but in this case absorption occurs mainly in internal organs. Such radiation is most harmful.

Excess heat is diverted to a certain limit by increasing the load on the thermoregulation mechanism. Starting with a certain value (J> 10 mW / cm2), called the thermal threshold, the body can not cope with the removal of the generated heat, the body temperature rises, which causes great harm to health. Absorption is most intense in organs with a high water content (blood, muscles, lungs, liver). However, heating is most harmful for tissues with an underdeveloped vascular system or with insufficient blood circulation and an insufficiently developed system of thermoregulation (eyes, brain, kidneys, stomach, intestines, bile and urinary bladder). Irradiation of the eye causes clouding of the lens (cataract). Usually cataracts do not develop immediately, but in a few days or weeks after irradiation. In addition to the thermal effect on human tissues, as on dielectric materials having some conductivity, electromagnetic fields affect tissues as biological objects. They directly affect the nervous system, change the orientation of cells or chains of molecules in accordance with the direction of the lines of force of the electric field, the biochemical activity of protein molecules and the composition of blood. Violated the functions of the cardiovascular system. There are changes in the carbohydrate, protein and mineral metabolism.

However, these changes are functional, reversible; it is enough to stop irradiation of an unacceptable level - and painful phenomena disappear. Norms of the electromagnetic field. Methods of protection. The levels of permissible irradiation in the Republic of Uzbekistan are so small that they do not cause any changes in the body even with prolonged systematic irradiation. "Sanitary norms and rules when working with sources of electromagnetic fields of high, ultrahigh and ultrahigh frequencies" No. 848-70 provide the following maximum permissible values:

the intensity of the electromagnetic fields of radio frequencies at workplaces should not exceed by an electrical component of 20 V / m in the frequency range 100 kHz - 30 MHz and 5 V / m in the frequency range 30-300 MHz; by the magnetic component, the limiting value is 5 A / m in the frequency range 100 kHz - 1.5 MHz. In the microwave band 300-300 000 MHz, the maximum allowable power flux density during irradiation during the whole working day is 10 μW / cm2, irradiation of not more than 2 hours per working day - 100 μW / cm2 and irradiation of not more than 15-20 minutes 1000 μW / cm2 subject to mandatory use of protective glasses. In the remaining working hours, the intensity of irradiation should not exceed 10 μW / cm2.

In the microwave range for persons not professionally involved with irradiation, and for the population, the power flux density should not exceed 1 μW / cm2. Formula shows that the weakening of the power of the electromagnetic field in the workplace can be achieved by increasing the distance between the antenna and the workplace; reducing the radiation power of the generator; installation of a reflective or absorbing shield between the antenna and the workplace; use of personal protective equipment.

"Distance protection" is the simplest and most effective method. It is quite applicable for personnel who, when performing work, do not need to be close to sources of electromagnetic radiation, as well as when controlling the radiating unit remotely. In order to be able to use this method, the room in which the work is done should be of sufficient size.

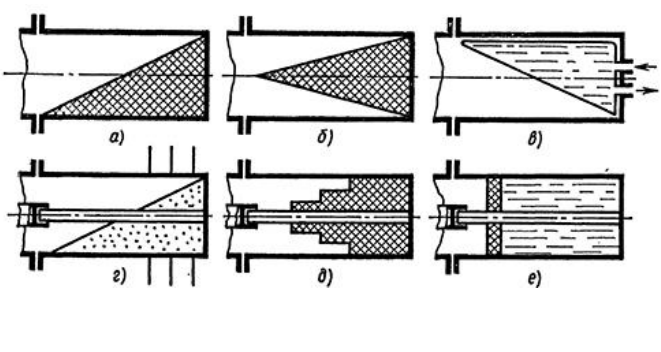


Fig. 4.1. Structures of absorbing loads for coaxial lines and waveguides.

One way to reduce the radiated power is to replace a powerful generator with a less powerful one, if this is possible by the technology of performing the work. Another way to reduce the power of radiation can be the use of absorbing loads - antenna equivalents or power attenuators - attenuators that completely absorb or, to the extent necessary, weaken the transmitted energy on its way from the generator to the radiating device.

Absorbing loads are coaxial and deep-water, their schemes are shown in Fig. 5.1. The energy absorber is a graphite or special carbonaceous composition, as well as various dielectrics with losses. To cool absorbing loads, use cooling fins (Figure 5.1, d) or running water (Fig. 5.1, c, e). To reconcile coaxial lines and waveguides with absorbing loads, use beveled (Figure 5.1, a and d), as well as wedge-shaped (Figure 5.1, b and c) and stepwise (Figure 5.1, d) transitions or dielectric washers (Figure 5.1 , e).

Attenuators used to reduce the radiation power to the required value and used in coaxial lines and waveguides are constant and variable. The first of them work on the principle of absorption of electromagnetic waves by materials with a large absorption coefficient. Such materials include rubber, polystyrene, etc. The "knife" and plates of such attenuators are made of a dielectric covered with a thin metal film and placed parallel to the electric lines of force of the electromagnetic field. Adjustment of attenuation attenuation is done by immersing the "knife" in the waveguide or by converging the plates, as a result of which the absorption of energy by the dielectric attenuator increases.

A very effective and often used method of protection from electromagnetic radiation is the installation of screens. You can either screen the radiation source itself or workplace. Reflective screens are made of highly conductive metals - aluminum, steel, better - from copper and brass. The protective action is due to the fact that the screened polo creates in the screen Foucault currents, which induce a secondary field in it, almost equal in amplitude, and opposite in phase to the screened field. The resulting field, obtained by adding these two fields, very quickly decreases in the screen, penetrating into it by a negligible amount. Calculate the attenuation given by the screen and the screen thickness. Let P0, J0 denote the power and flux density of the shielded radiation; P, J - power and flux density of power (attenuated) radiation behind the screen. Then the attenuation of radiation (dB) can be determined from formula

$$L = 10 \lg \frac{P}{P_0} = 10 \lg \frac{J}{J_0}.$$

The rate of decrease in the amplitude of the incident wave as it penetrates into the conducting medium characterizes the concept of depth of penetration, by which is meant the distance along the wave propagation, at which the amplitude of the incident wave Ea (or Ha) decreases by a factor of e [formula

(20)]. The depth of penetration is determined from expression

kz = 1, z = 1 / k Coefficient where y is the conductivity 1 / Ohm * m; μ - magnetic permeability, Ohm * s / m = G / m. Consequently, the penetration depth depends on the properties of the conducting medium and on the frequency ω. So, if the electromagnetic wave has a frequency f = 9 kHz and penetrates into the earth at which y = 105 1 / Ohm * cm (steel), then

$$\mu_r = \frac{\mu}{\mu_0} = 10^3,$$

where μ0 is the conductivity of the vacuum; μ = μaμr. The value of the coefficient

$$k = \sqrt{\frac{\omega\gamma\mu}{2}} = \sqrt{\frac{2\pi \cdot 9000 \cdot 4\pi \cdot 10^{-9} \cdot 10^3 \cdot 10^5}{2}} = 188{,}4\ 1/\text{см}.$$

Hence the depth of penetration z = 1 / k = 0.005 cm = 0.05 mm.

Thus, at a small distance of 0.05 mm, the amplitude of the incident wave Ea and Na will decrease by a factor of 2.7 even at a very low frequency; With increasing frequency, this quantity decreases even more.

The depth of penetration can also be calculated for any preset attenuation of the electromagnetic field if the weakening term e ~ hz equates to a given value of M:

$$e^{-kz} = M.$$

Prologarithmirovav this expression and solving it with respect to z, we get

$$z = \frac{\ln M}{k} = -\frac{\ln M}{\sqrt{\frac{\omega\gamma\mu}{2}}}.$$

Based on the strength of the screens, they should be made of a thickness of at least 0.5 mm from sheet material with high electrical conductivity. Observation windows and other technological holes should be screened with a thick metal grid with cells no more than 4X4 mm. The shield must be grounded. Seams between individual sheets of the screen or grid should provide reliable electrical contact between the elements to be connected, since otherwise the shielding efficiency will be insufficient. The seam is carried out by welding, soldering or spot welding with a step of no more than 50-100 mm.

To protect workers from electromagnetic radiation, it is also necessary to use grounded screens in the form of cameras or cabinets into which the entire transmitting equipment is placed; Enclosures, enclosing only antennas; screens mounted on the path of radiation. Measuring instruments Near the radiation sources (in the induction zone) in the frequency range from 50 Hz to 30 MHz, the electromagnetic field can be considered as a collection of practically independent electric and magnetic fields. Therefore, devices operating in this range should measure separately the intensity of the electric field and the strength of the magnetic field.

Various modifications of the IEMP-1 (electromagnetic field meter) are used to measure the field strengths, depending on the frequency bands and the measured strengths. The device consists of an amplifying unit, a set of antennas for measuring the electrical and magnetic field components, a voltage divider. To measure the electrical component, a dipole antenna is used, and for the measurement of the magnetic component, a loop antenna is used. Antenna is introduced into the field where it is necessary to measure its tension; changing the position of the antenna relative to the field lines of force, achieve the maximum reading of the arrow on the scale of the device.

Fig. 4.2. The meter of electromagnetic field voltage (Narda NBM-550).

Fig. 4.3. Low-frequency electromagnetic field voltage meter (C.A 42).

In order to eliminate the dangerous effects of current in industrial installations, automatic blocking, emergency shutdown or protective devices are used to prohibit work with the fence removed. Protective disconnection is particularly convenient as an electrical safety feature in mobile production plants. It can be applied as an independent, or together with other protective means.

In those cases when the considered methods of protection from electromagnetic radiation do not give sufficient effect, for example, when setting up antenna-feeder devices and determining the resolving power of radar stations, where the power flux density reaches hundreds or even thousands of microwatts per 1 cm2, it is necessary to use personal protective equipment. Means of individual protection against electromagnetic radiation include overalls, gowns, glasses. Overalls and dressing gowns are made of three layers of fabric: the outer and inner layers are made of cotton diagonal and calico, the middle protective layer is made of radio engineering cloth of the type RT art. 1551/2158, which has a conductive grid.

The average attenuation of the energy of an electromagnetic field with a wavelength of 3 cm at angles of incidence 0-80 ° should be not less than 21 dB. If work in overalls is performed in cramped conditions where there is a risk of electric shock, it is necessary to ground the overalls with a tap at the waist connected to the grounding wire. To protect the eyes from electromagnetic radiation, glasses of the brand ORZ-5, mounted in a hood or used separately, are used. Glasses of glasses are covered with semiconductor tin (Sn02), which gives a weakening of electromagnetic energy of at least 22 dB and is transparent to light.

Protection against laser beams. The nature and degree of the harmful effect is influenced by many factors: the direction of the laser beam, the duration of the radiation pulse, the spatial distribution of energy in the beam, the differences in the structure of various parts of the retina and its pigmentation, as well as the peculiarities of focusing each individual eye. Especially dangerous if the laser beam passes along the visual axis of the eye. Laser radiation can also cause damage to the skin and internal organs. Damage to the skin by laser radiation is similar to a thermal burn. The degree of damage is affected both by the output characteristics of the laser, and by the color and degree of skin pigmentation.

In a number of cases, there is an effect of both direct and mirror reflected laser radiation on individual human organs, as well as diffuse reflected radiation on the human body as a whole. The result of such an impact in a number of cases are various functional changes in the central nervous system, endocrine glands, increased physical fatigue, In the temporary sanitary norms approved by the Ministry of Health of the Republic of Uzbekistan, when working with optical quantum generators, the maximum permissible levels of irradiation of the cornea of the eye are established, ensuring the safety of the most sensitive part of the eye, the mesh shell, to the lesion.

In particular, for ruby lasers operating in the pulsed free-running mode, the maximum allowable energy flux density is 2 • 10-8 J / cm2, for niodimic lasers it is 2 • 10-7 J / cm2; for a helium-neon laser operating in a continuous regime, the limiting energy flux density is 1 • 10-6 W / cm2. For other types of optical quantum generators and their operation modes, it is necessary to completely eliminate the effect of radiation on personnel using protective equipment.

For the quantitative evaluation of direct and reflected radiation and the determination of safety zones around laser installations, one can use the usual formulas of ray optics. It must be borne in mind that protection by distance is not very effective because of the weak divergence of the laser beam.

Protection against radioactive emissions X-ray radiation is electromagnetic radiation that occurs when a substance is bombarded with an electron beam. It is a combination of the bremsstrahlung and characteristic radiation, the quantum energy range of which lies in the range from 1 keV to 1 MeV, depending on the value of the accelerating voltage between the anode and the cathode.

Practically X-rays can occur in any electrovacuum installation, in which fairly high voltages (tens and hundreds of kilovolts) are used to accelerate the electron beam. Like gamma radiation, it has a low ionizing capacity and a large depth of penetration. Radioactive emissions and their features. The activity of the radioactive preparation a is a measure of the amount of radioactive substance expressed by the number of acts of decay of atomic nuclei per unit time. For the unit of activity, decay per second (rp / s) is assumed.

An extra-systemic unit of activity is the curie. Curie (Ki) is the activity of the preparation, in which in 3.7 seconds there are 3.7-1010 decays of atomic nuclei. Derived units: 1 mCi - 3.7-107 cps, 1 μCi = 3.7-104 cps. There are exposure, absorbed and equivalent doses. To characterize the dose from the ionization effect, the so-called exposure dose of X-ray and gamma radiation is used, which is equal to the charge of charged particles of the same sign formed in a unit of mass of atmospheric air under the action of ionizing radiation: **Дэксл = Q/m,**

where Q is the charge of one sign formed upon the absorption of gamma or X-ray radiation in air of mass m.

The unit exposure dose of X-ray and gamma radiation is a pendant divided by a kilogram (K / kg). An x-ray is an extrasystem unit of the exposure dose of X-ray and gamma radiation. 1 X-ray (P) - dose, which in 1 cm3 of dry air under normal conditions produces in the air ions carrying a charge of each sign into one electrostatic unit. This unit characterizes the ionizing ability of X-ray and gamma radiation in the air, but not the absorbed energy.

The exposure dose [K / kg-s, (P / s)], referred to a unit of time, is called the exposure dose rate; is determined by the formula. Pexp = Dexp / t, where t is the irradiation time. The absorbed dose of radiation is a ratio of the energy E of the radiation absorbed in a certain volume of the medium to the mass m of this volume,

Дпогл = E/m

The unit of absorbed radiation dose is taken as the joule divided by kilogram. The extra-system unit of the absorbed radiation dose is rad; 1 rad = 10-2 J / kg. Derived units are millirad (mrad) and microrad (mrad). The magnitude of the absorbed dose depends on the properties of the radiation and the absorbing medium. The absorbed dose [W / kg (rad / s)] per unit time is called the absorbed dose rate; is determined by the formula

Рпогл = Дпогл/t

Due to the fact that the same absorbed dose of different types of radiation causes a different biological effect in a unit of biological tissue mass, the concept of an equivalent dose is introduced. Equivalent dose of ionizing radiation Dekv is the value introduced to assess the radiation hazard of chronic irradiation and is determined by the product of the absorbed dose Д Pa quality factor of the QC of a given type of radiation; is determined by the formula

Дэкв = Д*КК*КР.

The unit of equivalent dose (biological equivalent of rad) is called rem. For comparison of different types of ionizing radiation according to the expected biological effect, the QC quality factor is used, which shows the effectiveness of this type of radiation with respect to x-rays with an energy of 250 keV.

The impact of radioactive rays on the human body Ionization of living tissue leads to the rupture of molecular bonds and a change in the chemical structure of various compounds. Changes in the chemical composition of a significant number of molecules lead to cell death.

Under the influence of radiation in living tissue, water splits into atomic hydrogen H and OH hydroxyl group, which, having a high chemical activity, enter into a connection with other tissue molecules and form new chemical compounds that are uncharacteristic of healthy tissue. As a result of the changes that have occurred, the normal course of biochemical processes and metabolism are violated.

Under the influence of ionizing radiation in the body, inhibition of the functions of the hematopoietic organs, disruption of normal blood clotting and an increase in the fragility of blood vessels, upsetting of the gastrointestinal tract and depletion of the organism, a decrease in the body's resistance to infectious diseases,

It is necessary to distinguish between external exposure and internal. Under external irradiation, one should understand the effect of radiation on a person when the source of radiation is located outside the body and the probability of radioactive substances entering the body is excluded. This is the case, for example, when working on X-ray machines and accelerators or when working with radioactive substances in hermetic ampoules. With external irradiation, beta, gamma, X-ray and neutron radiation are the most dangerous. The biological effect depends on the dose of irradiation, the type of it, the time of exposure, the size of the irradiated surface, the individual sensitivity. Alpha- and beta-particles, having an insignificant penetrating power, cause only skin lesions with external irradiation. Hard X-rays and gamma rays can lead to a fatal outcome, without causing changes in skin integument upon external irradiation.

When working with radioactive substances, intensive irradiation can be exposed to the hands, whose skin lesions can be chronic or rapid. The first signs of chronic lesions are usually found not immediately after the start of work, they appear in the dryness of the skin, cracks in it, its ulceration, brittle nails, hair loss.

In acute radiation burn of the bones of the hands, edema, blisters and necrosis of the tissues are observed, and long-term healing ulcers may occur, where cancer can occur at the site of formation. As a result of the impact on a person of all natural radiation sources (cosmic rays, radioactivity of surrounding objects and soils, etc.), the total dose of irradiation taken by the RUZ averages 125 mrem / year. In addition to natural irradiation, a person is irradiated by other sources, for example, when the stomach is illuminated - 1,5-3 P, teeth - 3-5 P, light - 0,15-0,2 P, when watching TV directly at the screen (TVs with large screen) 0.5 mR / h.

A single irradiation in a dose of 25-50 rem leads to insignificant transient changes in the blood, at radiation doses of 80-120 rem there are initial signs of radiation sickness, but there is no fatal outcome. Acute radiation sickness develops with a single irradiation of 270-300 rem, a fatal outcome is possible in 20% of cases. A fatal outcome in 50% of cases occurs at doses of 550-700 rem. These data refer to the case when treatment is not performed. Currently, there are a number of anti-radiation drugs that can significantly reduce the effects of radiation.

Diseases caused by radiation can be acute and chronic. Acute lesions occur when exposed to large doses for a short period of time. A characteristic feature of acute radiation sickness is the cyclical nature of its course, in which four periods can be outlined schematically: the primary reaction, visible well-being ("hidden period"), the height of the disease and recovery.

Normalization of ionizing radiation

The maximum permissible dose of SDA is the annual level of personnel exposure, which does not cause unfavorable changes in the health status of the irradiated person and his offspring, if the dose is uniformly accumulated for 50 years.

Based on the possible consequences of the effect of ionizing radiation on the body, the following categories of irradiated persons are established: category A - personnel; category B - individuals from the population; category B - the population as a whole (when assessing the genetically significant dose of irradiation).

The maximum permissible doses of traffic regulations for external and internal radiation are established for four groups of critical organs or tissues: I - the whole body, gonads, red bone marrow; II -

muscles, fatty tissue, liver, kidneys, spleen, gastrointestinal tract, lungs, lens of the eye and other organs, except those belonging to groups I, III, IV; III - bone tissue, thyroid gland and skin (except for the skin of hands, forearms, ankles and feet); IV - Brushes, forearms, ankles and feet.

Among the personnel (category A) two groups are distinguished:

1) persons whose working conditions are such that the radiation doses may exceed 0.3 annual SDA (work in the controlled area);

2) persons whose working conditions are such that the radiation doses can not exceed 0.3 annual SDA (work outside the controlled area). This group includes adults who work at the enterprise in the neighborhood of premises where work is being done with sources of ionizing radiation; persons working in administrative and business premises, as well as in all buildings and in the open air within the sanitary protection zone; Persons who occasionally visit the controlled area.

For individuals working in the controlled area, individual dosimetric control and special medical supervision are mandatory.

Individuals from the staff, with the exception of women under the age of 30, may receive a single dose for the entire body, gonad or red marrow, within 3 quarters, within one quarter. For women under the age of 30, a single dose for one quarter should not exceed 1.3 rem.

The genetically significant dose of external and internal radiation received by the population as a whole from all sources of radiation should not exceed 5 rem in 30 years. This dose does not include possible doses of radiation due to medical procedures and a natural radiation background.

The average annual permissible concentration of radioactive substances in the body, water and air (KFOR) is the maximum permissible quantity (activity) of the radioactive isotope in a unit of volume or mass, the supply of which in the body in natural ways (with daily consumption of water or air) does not create in critical organs and in the body as a whole, radiation doses exceeding the maximum permissible. With a constant concentration of radioactive isotope in the air between the RAP and KFOR for persons of category A, there is the following relationship:

ПДП (мкКи/год) = 106 СДК (Ки/л) • Q (л/год),

where for air Q = 2,5 * 106 liters / year. When working with radioactive substances, it is possible to contaminate working surfaces, and sometimes the hands and bodies of workers, Contaminated surfaces and the body can be potential sources of both internal and external exposure. First, when people move and perform various jobs in a room where the floor, walls or equipment are contaminated with radioactive substances, the latter, together with the dust, can rise into the air, creating an increased concentration of radioactive aerosols.

Secondly, radioactive substances can penetrate into the body by sucking through contaminated skin; In addition, one can not ignore the possibility of radioactive substances entering the mouth from contaminated hands. Measures to combat radioactive radiation. The safety conditions for the use of radioactive isotopes in industry require the implementation of protective measures not only for people directly working with radioactive substances, but also for those who are in adjacent premises and the population living at close distances from the enterprise who may be exposed to radioactive radiation.

The safety of workers with radioactive substances is ensured by establishing the maximum permissible radiation doses for various types of radioactive substances, the use of time or distance protection, general protective measures, and the use of personal protective equipment. Of great importance is the use of individual and general control devices to determine the intensity of radioactive emissions.

Protection of workers working with radioactive isotopes from harmful effects of ionizing radiation is carried out by a system of technical, sanitary-hygienic and medical-preventive measures.

The premises intended for working with radioactive isotopes should be separate, isolated from other premises and specially equipped. It is desirable in one room to work with substances of the same activity, which facilitates the construction of protective equipment. Walls, ceilings and doors are made smooth so that they do not have pores or cracks. All corners in the room are rounded to facilitate the cleaning of the premises from radioactive dust. The walls are covered with oil paint to a height of 2 m, and when there are radioactive aerosols or vapors in the air, both the walls and ceilings are covered with oil paint completely.

Floors are made of dense materials that do not absorb liquids, using for this purpose linoleum, PVC or Metlakh tiles. The edges of linoleum and plastic are raised along the walls to a height of 20 cm and carefully closed. The room must provide air heating. It is mandatory to supply air and exhaust ventilation with at least five times the air exchange. The maintenance of premises in cleanliness, and the equipment in full serviceability is the basic requirement. If the equipment malfunctions, its operation should be stopped immediately. Daily work is carried out wet cleaning to prevent the accumulation of open radioactive contamination.

General cleaning of premises with washing hot soapy water of walls, windows, doors and all furniture must be done once a month. Cleaning tools in order to prevent the spread of pollution from the premises are not carried out and stored in closable cabinets or metal boxes. Before working with radioactive substances, carefully check the effect of ventilation, the state of equipment and personal protective equipment.

Boxes are designed for work with gaseous and volatile radioactive substances. Work in closed boxes is carried out using rubber gloves embedded in them or a mechanical manipulator. The boxes are equipped with a closed ventilation system: the supply air is supplied by an independent air duct system, and the removed contaminated air is cleaned in the individual filter of the box. Prevention of air leaks from the box is ensured by the creation of a vacuum of air of 100-200 Pa in the box. To work with radioactive substances, special hoods are used, equipped with local suction, a protective window with lead glass, sliding lead curtains.

Measuring instruments. The safety of work with radioactive substances and radiation sources can be ensured by organizing systematic dosimetric monitoring of the levels of external and internal exposure of the operating personnel, as well as the level of radiation in the environment. Dosimetric control is one of the essential factors of the radiation safety system. The scope of dosimetry control depends on the nature of work with radioactive substances. If the work is carried out with closed sources of radiation, then it suffices to confine itself to measuring the dose of gamma radiation in the main and auxiliary rooms, at the workplaces of permanent and temporary stay of maintenance personnel.

When working with open radioactive substances, for example in hot laboratories, as well as in nuclear reactors where radioactive substances can escape from the primary circuit system or the appearance of radioactive gases and aerosols, in addition to measuring the levels of external radiation fluxes, it is also necessary to monitor air pollution levels and working surfaces with radioactive substances in working and adjacent areas, as well as the level of contamination of hands and clothing workers.

Fig. 2.4. The dosimeter RADEX ISS-1009.

The scintillation method for detecting emissions is based on measuring the intensity of light flashes occurring in luminescent substances when ionizing radiation passes through them. A photoelectric multiplier (PMT) with a recording electronic circuit is used to register the light flashes. Substances that emit light under the influence of ionizing radiation are called scintillators (phosphors, fluorines, phosphors). The photomultiplier makes it possible to convert weak flashes from the scintillator into sufficiently large electrical pulses, which can be registered with ordinary simple electronic equipment.

Scintillation counters can be used to measure the number of charged particles, gamma quanta, fast and slow neutrons; to measure dose rate from beta-gamma and neutron radiation; to study the spectra of gamma and neutron radiation. Semiconductor, as well as photo- and thermoluminescent detectors of ionizing radiation have become very popular in the last decade.

Individual protection means. When working with radioactive isotopes, dressing gowns, overalls and overalls made of unpainted cotton fabric, as well as cotton hats, can be used as the basic overall. If there is a danger of considerable contamination of the premises with radioactive isotopes over cotton clothes, you should wear film clothing (armlets, trousers, apron, robe, suit) covering the entire body or only the places of greatest pollution. Such clothing provides more complete protection of the surface of the body working from the ingress of radioactive substances, dust, as well as acids and alkalis, which can be used when working with radioactive substances.

As materials for the manufacture of film clothing, some types of plastics, organic glass, some types of rubber and other materials that can be easily cleaned of radioactive contamination can be used. In the case of the application of film clothing, it is necessary to provide for its design so that it allows the supply of air directly under the suit, armlets. For work with open radioactive substances having an activity of more than 10 μCi, gloves made of lead rubber with flexible armlets are used to protect the hands. To carry out repairs, in which the pollution can be very large, air suits made of plastic materials with forced delivery under the suit of air have been developed.

To carry out repairs, in which the pollution can be very large, air suits made of plastic materials with forced delivery under the suit of air have been developed. Sometimes during repair work or other works with isotopes, you need to protect only the respiratory system and there is no need to use a pneumatic suit. In this case, use respirators, gas masks and other devices. Hose gas masks provide more reliable protection from radioactive contamination. The air in the gas mask is supplied from an uncontaminated place by self-priming or forced. To protect the eyes, closed glasses are used with glasses containing tungsten phosphate or lead. Due to the fact that ordinary footwear easily absorbs radio activities Wear and remove gloves should be so that their outer side does not touch the inner and that the bare fingers do not touch the external contaminated side. If gloves have at least a small damage, they must be replaced.

THEME 5.

ACTION OF ELECTRIC CURRENT ON THE ORGANISM. ELECTRICAL SAFETY

Plan:

1. The effect of electric current on the body.
2. Electrical resistance of the body.
3. The main causes of injury from electric current.
4. Protective equipment used in electrical installations.
5. Analysis of electrical safety conditions. Step voltage.
6. First aid for injuries from electric current.

Basic terms: *electric current, voltage electric energy, electro-trauma, thermal influence, electrolytic influence, biological effect, mechanical trauma, burn from lecracies, earthing, electro-isolation, zero,* *electrical resistance of the organism, artificial respiration.*

The effect of electric current on the body. Passing through the body, the electric current produces thermal, electrolytic and biological effects. Thermal action is expressed in the burns of individual parts of the body, the heating of blood vessels, nerves, etc. The electrolytic action is expressed in the decomposition of blood and other organic liquids, causing significant disruption of their physicochemical compositions.

Biological action is a special specific process, peculiar only to living tissue. It is expressed in the stimulation and excitation of living tissues of the body, which is accompanied by involuntary convulsive contractions of the muscles, including the muscles of the heart and lungs. As a result, various abnormalities in the body can occur, including violation and even complete cessation of the respiratory and circulatory system. The irritating effect of current on body tissues can be direct when the current passes directly through these tissues and reflex, ie through the central nervous system, when the current path lies outside these tissues.

All this variety of actions of an electric current leads to two kinds of defeat: electric traumas and electric impacts. Electrical injuries are clearly expressed local injuries of body tissues caused by the action of electric current or electric arc. Distinguish the following electrical injuries: electrical burns, electrical signs, skin metallization and mechanical damage.

Electrical burns can be caused by the flow of current directly through the human body, as well as by the action of an electric arc on the body. In the first case, the burn occurs as a result of the conversion of the electric current into thermal energy and is comparatively light (reddening of the skin, the formation of bubbles). Burns caused by an electric arc are, as a rule, of a severe nature (necrosis of the affected area of the skin and charring of tissues). Electrical signs are clearly defined patches of gray or pale yellow in diameter 1-5 mm on the surface of a person's skin exposed to a current.

Electrical signs are painless and their treatment ends, as a rule, safely. Metallization of the skin is the penetration into the upper layers of the skin of the smallest particles of metal, which melted under the action of an electric arc. Usually, over time, the diseased skin descends, the affected area acquires a normal appearance and painful sensations disappear. Mechanical damage is the result of sudden involuntary convulsive contractions of muscles under the influence of current passing through a person. As a result, there may be ruptures of the skin, blood vessels and nervous tissue, as well as dislocation of the joints and even bone fractures. Mechanical damage occurs very rarely.

Electric shock is the excitation of living tissues of an organism through an electric current, accompanied by involuntary convulsive contractions of muscles. Distinguish the following four degrees of impact:

I - convulsive muscle contraction without losing consciousness;

II - convulsive contraction of muscles with loss of consciousness, but with preserved breathing and work of the heart;

III - loss of consciousness and violation of cardiac activity or breathing (or both);

IV - clinical death, i.e., absence of respiration and circulation.

Clinical ("imaginary") death is a transitional process from life to death, coming from the moment of the cessation of the activity of the heart and lungs. A person who is in a state of clinical death lacks all signs of life: he does not breathe, his heart does not work, painful irritations do not cause any reactions, the pupils of the eyes are dilated and do not react to light. However, during this period, life in the body has not completely died out, because its tissues do not die all at once and do not immediately fade the functions of various organs. At first, metabolic processes are continuing in almost all tissues, although at a very low level and sharply differing from the usual, but sufficient to maintain a minimal vital activity.

These circumstances allow, by working on the more enduring vital functions of the organism, to restore fading or just extinguished functions, i.e., to revive the dying organism.

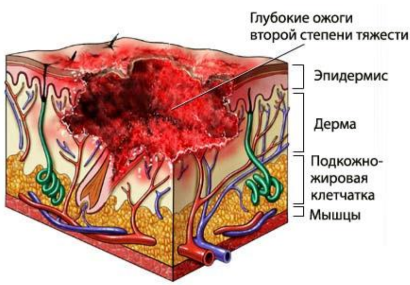


Fig. 5.1. Burn as a result of electric injury

The outcome of the effect of an electric current depends on a number of factors, including the electrical resistance of the human body, the magnitude and duration of the current flowing through it, the kind and frequency of the current, and the individual properties of the person.

Fig. 5.2. Electricity in the form of lightning

First, the cells of the cerebral cortex, very sensitive to oxygen starvation, begin to die, with the activity of which consciousness and thinking are connected. Therefore, the duration of clinical death is determined by the time from the moment of cessation of cardiac activity and respiration before the death of cells in the cerebral cortex; in most cases it is 4-5 minutes, and when a healthy person dies from accidental cause, for example from an electric current, 7-8 minutes. Biological (true) death is an irreversible phenomenon, characterized by the cessation of biological processes in the cells and tissues of the body and the breakdown of protein structures; it occurs after the period of clinical death.

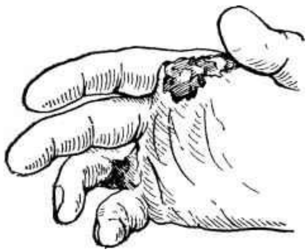


Fig. 5.3. Metalization of the skin under the influence of electricity

Electrical resistance of the body. The electrical resistance of the human body is made up of the resistance of the skin and the resistance of the internal tissues. The skin, or rather its upper layer, called the epidermis, having a thickness of up to 0.2 mm and consisting mainly of dead keratinized cells, has a great resistance, which determines the total resistance of the human body. Resistance of human internal tissues is insignificant and is 300-500 Ohm.

With dry, clean and undamaged skin, the resistance of the human body ranges from 2 thousand to 2 million

Ohm. When the skin is moistened and contaminated, as well as when the skin is damaged (under the contacts), the resistance of the body turns out to be the smallest - 300-500 Ohm, that is, it reaches a value equal to the resistance of the internal tissues of the body. In calculations, the resistance of the human body is assumed to be 1000 Ohm. The magnitude of the current flowing through the human body is the main factor on which the outcome of the lesion depends: the more current, the more dangerous its effect. A person begins to sense the current flowing through it of an industrial frequency (50 Hz) relatively small: 0.6-1.5 mA. This current is called the threshold perceptible current.

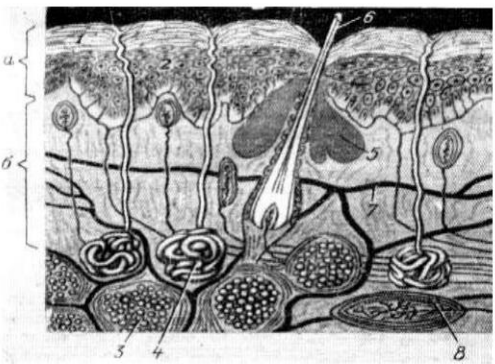


Fig. 3.4. The human skin (in a cut) a) the epidermis is the outer layer; b) dermis-inner layer; 1) the top layer; 2) the layer is growing; 3) a layer of fat; 4) sweat iron; 5) iron fat; 6) hair; 7) the vessel; 8) nerves

Hands are difficult to tear off the electrodes. Severe pain in fingers and hands. The condition is tolerable 5 - 10 s. Hands are paralyzed immediately, it is impossible to tear them from the electrodes. Very severe pain, difficulty breathing. The condition is tolerable for no more than 5 s. Paralysis of the respiration, the onset of trembling of the ventricles of the heart (fibrillation). Respiratory paralysis. With a duration of 3 s or more, paralysis of the heart. Paralysis of respiration and heart when exposed to a current of more than 0.1 s. destruction of body tissues by the thermal action of the current. Itching, sensation of heating.

Heating gain. An even greater increase in heating. Slight contraction of the muscles of the hands. Strong feeling of heating. Reduction of the muscles of the hands. Convulsions, difficulty breathing. Respiratory paralysis.

Paralysis of the respiration, heart. At low voltages (up to 100 V), the DC current is about 3-4 times less dangerous than the alternating current at a frequency of 50 Hz; at voltages of 400-500 V, the danger is compared, and at higher voltages, the direct current is even more dangerous than the alternating current. The most dangerous current is the industrial frequency (20-100 Hz). Reduction of the danger of the action of current on a living organism is noticeably affected at a frequency of 1000 Hz and higher. Currents of high frequency, ranging from hundreds of kilohertz, cause only burns, without affecting the internal organs. This is due to the fact that such currents are not capable of causing excitation of nervous and muscle tissues.

Important for the outcome of the defeat is the path of electric current through the human body. It is established that the tissues of different parts of the human body have different resistivities. When the current passes through the human body, most of the current passes along the path of least resistance, mainly along the blood and lymphatic vessels. The most dangerous is the current path along the body, for example, from the hand to the foot or through the heart, the head, the human spinal cord. However, deadly lesions are known when the current passes along the path of the leg-leg or hand-arm.

Contrary to the established opinion, the greatest value of the current through the heart is not along the path of the left hand - the legs, but along the way the right hand - legs. This is due to the fact that most of the current enters the heart along its longitudinal axis, lying along the way the right arm-legs. One of the factors affecting the outcome of the lesion is the resistance of the human body. The electrical resistance of a person's body is the resistance to a current passing through a section of the body between two electrodes applied to the surface of a person's body. It consists of two thin outer layers of skin, touching the electrodes, and the internal resistance of the hands and body of rvr and rvk (Fig. 3.1). The electrical diagram of the human body is shown in Fig. 3.1b.

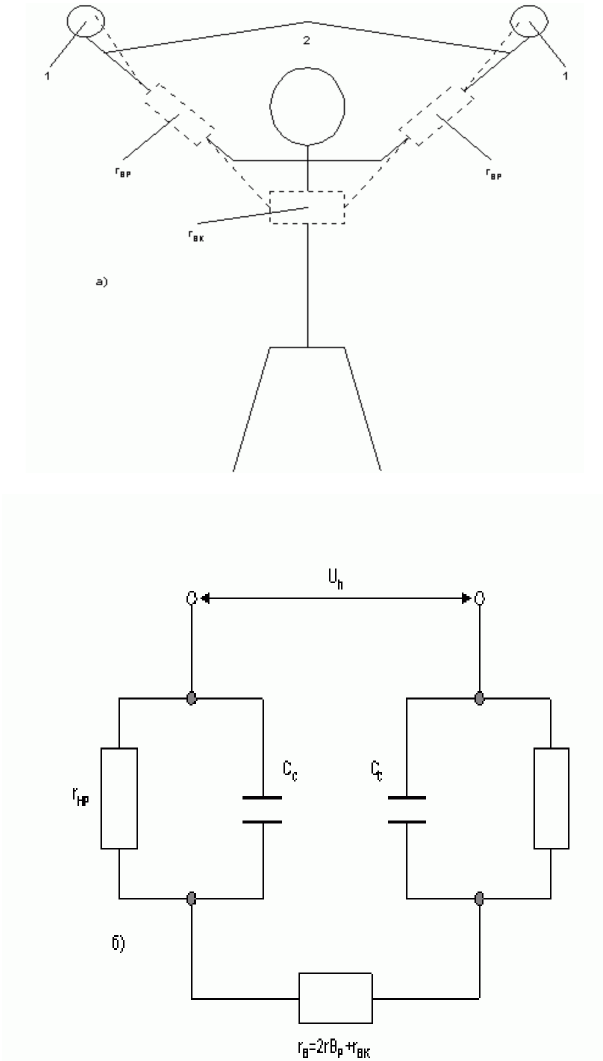


Fig. 5.1. Electrical resistance of the human body:

a) real resistance of human body elements: 1 - electrodes, 2 - external resistance of hands (upper layers of skin), rvr - internal resistance of hands, rvk - internal resistance of the body. b) the electrical circuit of the human body: rrr - the external resistance of the hands, Cp - the capacitive resistance of the hands, rb - the internal resistance, consisting of the internal resistance of the hands and the body, Uh - the tension applied to the human body.

The skin consists of two main layers: the outer - the epidermis and the inner - the dermis.

The epidermis, in turn, also has several layers. The upper, thickest layer is called horny (dead necrotic cells), and the layer below it is a germ (live cells). In a dry, unpolluted state, the stratum corneum can be considered as a dielectric, its resistivity is 1000 times greater than the resistance of other layers of the skin and internal tissues of the body. The electrical resistance of the dermis is insignificant, it is many times less than the resistance of the stratum corneum.

External resistance of the human body consists of the resistances of the two outer layers of the skin adjacent to the electrodes (Fig. 5.1). In other words, the external resistance consists of the active resistance rpp and the capacitive resistance Cp (5.1b). At the place of contact of the electrode with the human body (Fig. 5.1a), a kind of condenser is formed, with one electrode electrode, the other with internal conductive tissues, and the dielectric with the outer skin layer. The internal resistance of the human body - the resistance of the inner layers of the skin and internal tissues of the body - is considered active, it depends on the length and cross section of the body section and does not depend on the frequency of the current.

The impedance consists of three series-connected resistances: two identical resistances of the outer layer of the skin, rnri of the so-called internal resistance of the body rb (see Fig. 3.1b), which includes the internal resistance of the arm rvp, the internal resistance of the rvc case and the capacitance of the arm. The value of human rnp resistance depends on the condition of the horny layer of the skin, the presence of moisture and pollution on its surface, as well as the location of the electrodes, the frequency of the current and the duration of the current flow. Damage to the stratum corneum (cuts, scratches, abrasions and other micro-traumas), as well as moisturizing, sweating and contaminating the skin reduce the resistance of the human body, which increases the danger of its damage

Contamination of the skin with various substances, especially those that conduct a good electrical current (metal or coal dust, scales, etc.), reduces its resistance. Different parts of the body have different thickness of the stratum corneum and uneven distribution of sweat glands, therefore, they have different resistance. With increasing current strength and time of its passage, the resistance of the body decreases, as local heating of the skin increases, and this leads to an expansion of the vessels and, consequently, to an increase in the supply of this region with blood and an increase in sweating.

With increasing stress, the resistance of the skin decreases tens of times, and consequently, the resistance of the body as a whole also decreases; It approximates the resistance of the internal tissues of the body, i.e. to its lowest value (300 -500 Ω). This can be explained by the electrical breakdown of the skin layer, which occurs at a voltage of 50 - 200 V. Resistance of different parts of the human body is not the same. This is explained by the different thickness of the horny layer of the skin, the uneven distribution of sweat glands on the surface of the body and the uneven degree of filling the blood vessels with blood. Therefore, the value of the resistance of the body depends on the place of application of the electrodes.

The resistance of the human body (Rh) in practical calculations is taken equal to 1000 Ohm. In real conditions, the resistance of the human body - the magnitude is not constant and depends on a number of factors.

When the value of the applied voltage is 36 V, the resistance Rh is assumed to be 6 kOhm. The main factors of the body's damage by electricity Cases of human injury by current are possible only when the electrical circuit is closed through the human body or, in other words, when a person touches not less than two points of the chain between which there is some tension.

The danger of this touch, estimated by the amount of current passing through the human body, or by the touch voltage, depends on a number of factors: the circuit of the person's inclusion in the circuit, the voltage of the network, the circuit of the network itself, its neutral mode, the degree of isolation of live parts from the ground, the value of the capacitance of current-carrying parts relative to the ground, and so on.

Schemes of human inclusion in the chain can be different. However, the most characteristic are two switching circuits: between two wires and between one wire and ground (Figure 68). Of course, in the second case, it is assumed that there is an electrical connection between the network and the ground. With a two-phase switch-on, the danger of damage will not decrease even if the person is reliably isolated from the ground, ie if he has rubber overshoes or boots on his feet or stands on an insulating (wooden) floor or on a dielectric mat.

Single-phase inclusion occurs much more often, but is less dangerous than a two-phase inclusion, since the voltage under which a person turns out does not exceed the phase voltage, ie, less than a linear one in 1.73 times. Accordingly, the current passing through the person is less.

In addition, the magnitude of this current is also affected by the neutral mode of the current source, insulation resistance and capacitance of wires relative to the ground, the resistance of the floor on which the person stands, the resistance of his shoes and some other factors.

Electric shock. An electric shock is the excitation of living tissues of an organism through an electric current, accompanied by sharp convulsive contractions of muscles, including the At voltages above 1,000 V, arc faults may occur as a result of accidental short circuits. Electrical signs and electrical tags Electrical signs or electrical tags are clearly defined gray or pale yellow spots on the surface of a person's skin exposed to a current. Usually, the electrical signs have a round or oval shape with a recessed center in the size of 1 to 5 mm. Metallization of the skin muscles of the heart, which can lead to cardiac arrest. Local electrotrauma means damage to the skin and muscle tissue, and sometimes ligaments and bones. These include electrical burns, electrical signs, skin metallization, and mechanical damage. Electrical burns

Electrical burns - the most common electrical injury, occurs as a result of a local effect of the current on the tissue. Burns are of two types - contact and arc. Contact burn is a consequence of the conversion of electrical energy into thermal energy and occurs mainly in electrical installations with voltages up to 1,000 V. Electric burn is like an emergency system, protecting the body, since charred tissues, due to greater resistance than ordinary skin, do not allow electricity to penetrate deep into vital systems and organs. In other words, thanks to the burn, the current goes into a dead end.

When the body and voltage source were not touching tightly, burns are formed at the input and output points of the current. If the current passes through the body several times in different ways, multiple burns occur. Multiple burns occur most often at voltages up to 380 V due to the fact that such a voltage "magnetizes" a person and takes time to detach. The high-voltage current does not possess such "stickiness". On the contrary, he discards a person, but such a short contact is enough for serious deep burns. At voltages above 1,000 V, electrical trauma occurs with extensive deep burns, since in this case the temperature rises throughout the current path.

At voltages above 1,000 V, arc faults may occur as a result of accidental short circuits.

Electrical signs and electrical tags. Electrical signs or electrical tags are clearly defined gray or pale yellow spots on the surface of a person's skin exposed to a current. Usually, the electrical signs have a round or oval shape with a recessed center in the size of 1 to 5 mm.

Metallization of the skin. Metallization of the skin - is the loss of the smallest particles of molten metal on the exposed surface of the skin. Usually, this phenomenon occurs in the case of short circuits, the production of electric welding work. On the affected area there is pain from burns and the presence of foreign bodies. **Mechanical damage.** Mechanical damage is the result of convulsive contractions of muscles under the influence of current passing through a person, leading to rupture of the skin, muscles, tendons. This happens when the voltage is below 380 V, when a person does not lose consciousness and tries to free himself from the current source.

Causes of electric shock

• touching live parts, bare wires, contacts of electrical appliances, knife switches, lamp cartridges, fuses under voltage;

• touching parts of electrical equipment, metal structures of structures, etc., which are not in the normal state, but as a result of damage (breakdown) of insulation found under voltage:

• finding near the place of connection to the ground of the broken wire of the power network;

• Location in the immediate vicinity of current-carrying parts that are energized above 1000 V;

• touching a live part and a wet wall or a metal structure connected to the ground;

• Simultaneous contact with two wires or other live parts that are live;

• uncoordinated and erroneous actions of the personnel (supply of voltage to the installation where people work, leaving the installation energized without supervision, admission to work on the disconnected electrical equipment without checking for a lack of voltage, etc.).

The danger of electric shock is different from other production hazards in that a person is unable to detect it without a special device at a distance. Often this danger is revealed too late, when a person has already been under stress. Analysis of hazards in three-phase networks

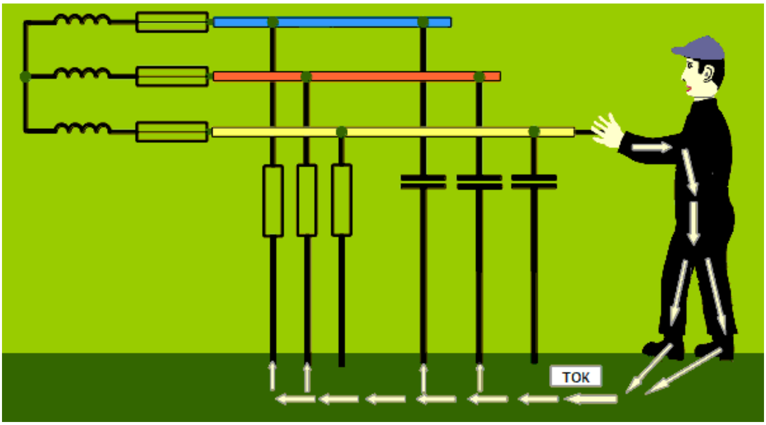


Fig. 5.6. The scheme of an isolated three-phase network

The analysis of the danger conditions of three-phase electrical networks practically reduces to determining the amount of current flowing through a person and to the evaluation of the influence of various factors: the circuit of the person's inclusion in the circuit, the voltage of the network, the circuit diagram of the network itself, its neutral mode, the isolation of live parts from the ground, etc. In a three-phase three-wire network with an isolated neutral, the current (A) passing through the human body when it touches one of the phases of the network during its normal operation (Figure 5.6) is determined by the following expression in a complex form:

$$I_{ч} = U_{Ф}/R_{ч} + Z/3,$$

where Z is the complex of the impedance of one phase relative to the ground.

With good insulation (R = 0.5 MΩ), the current has a small value and such a touch is not dangerous. Therefore, it is very important to provide high insulation resistance in such networks and to monitor its condition for the timely elimination of the arisen faults. If the network has a large capacitance relative to the ground (branched cable lines), a single-phase contact will be dangerous, despite the good insulation of the wires. 1000 V.

$$I_{\text{ч}} = \frac{U_{\text{ф}}}{\sqrt{R_{\text{ч}} + (X_c / 3)^2}},$$

where Xc is the capacitive resistance, equal to 1 / c, Ohm; c is the phase capacitance relative to the ground.

In networks with an isolated neutral, it is especially dangerous to touch a working phase when any other phase, for example the second phase, is grounded to ground (Figure 5.7). In this case, the person turns on the full line voltage.

$$I_{\text{ч}} = \frac{\sqrt{3} U_{\text{ф}}}{R_{\text{ч}}}.$$

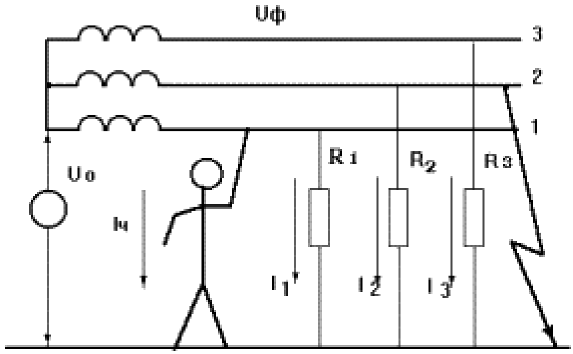


Fig. 5.7. Network layout with isolated neutral

In networks with grounded neutral, the neutral resistance of the neutral R3 is very small in comparison with the leakage resistance R. Therefore, the current flowing through the person is determined by the phase voltage of the UF network, the resistance of the floor and the shoes of the RPO and the earth resistance of the neutral R3 (Fig. 5.8).

$$I_{Ч} = U_{Ф}/R_{Ч} + R_{ПО} + R_{З}.$$

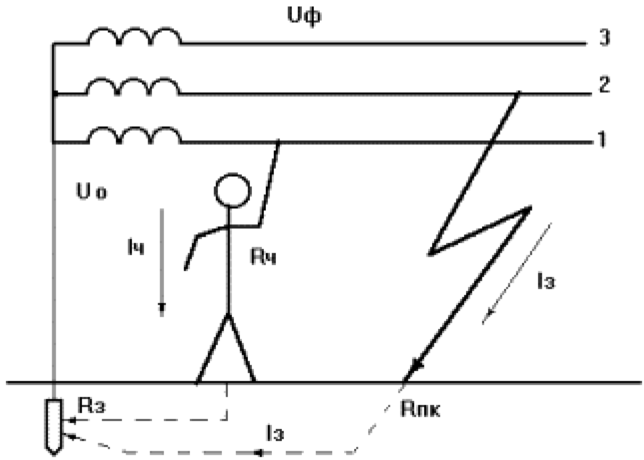


Fig. 5.8. Diagram of a network with earthed neutral

It follows that touching the phase of a three-phase network with a grounded neutral during its normal operation is more dangerous than touching the phase of a normally operating network with an isolated neutral. In the emergency mode of operation, when one of the phases of the network is closed to the ground through a relatively small RCP resistance (phase 2), and the person touches one of the other two phases, the person is approximately under phase voltage (R3 is small, figure

5.9). This is one of the advantages of networks with earthed neutral in terms of safety.

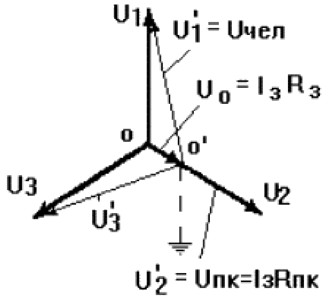


Fig. 5.9. Vector diagram with earth fault

When analyzing networks with voltages higher than 1000 V, it should be noted that these networks have a large length, have a significant capacity and a high value of insulation resistance. Therefore, in these networks, current leakage through the active insulation resistance can be neglected and only the leakage of current through the phase capacitance relative to the ground can be taken into account. Consequently, touching these networks is dangerous, regardless of the neutral mode. In accordance with the electrical network, 6-35 kV networks are made with an isolated neutral or neutral ground through a reactive coil in order to reduce the earth fault current. Networks with a voltage of 110 kV and above are made with grounding of the neutral.

The selection of the network layout, and therefore of the neutral mode of the current source, is based on the technological requirements and the safety conditions. According to technological requirements at a voltage of up to 1000 V, a four-wire network is preferred, since it allows the use of two operating voltages: linear and phase. Under security conditions, the choice of one of the two systems is made taking into account the conclusions obtained in the consideration of these networks. Networks with isolated neutral can be used if there is a good level of insulation maintenance and low network capacity. (networks of electrical laboratories, small enterprises, etc.).

Networks with earthed neutral should be used where it is not possible to provide good insulation of the wires (due to high humidity, aggressive environment, large capacitive currents, etc.). Examples of such networks are large modern enterprises.

Danger of AC power.

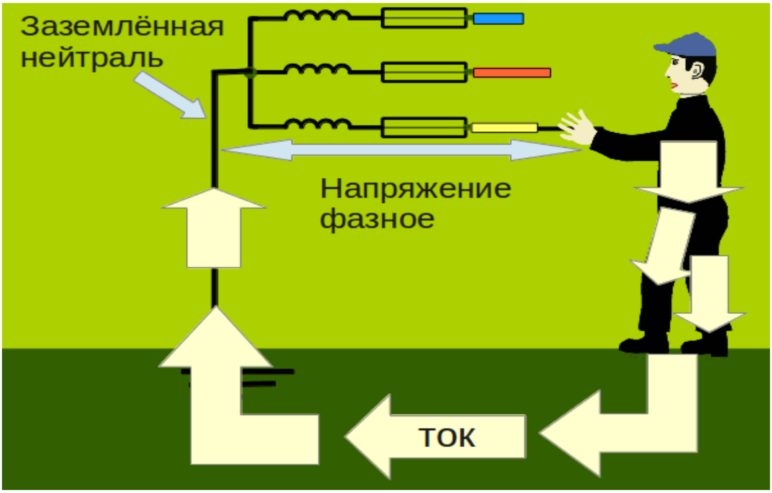


Fig. 5.10. Danger of single-phase current networks: a is a scheme of contacting an isolated network wire; b - equivalent circuit; c - the scheme of contact to an ungrounded network wire with a grounded pole; d - scheme of contacting the wire of a faulty network; д - the scheme of contact to a wire of a network with the grounded average point; e - scheme of touching two wires of the network

Single-phase networks can be isolated from the ground, have a grounded pole or midpoint (Figure 5.10). In the case of a single-pole contact with a wire of an isolated network, a person is "connected" to another wire through the leakage resistance (Figure 5.10, a). Since single-phase AC networks have a small length, the capacity of the wires is relatively the ground can be neglected, and for DC networks the capacitance does not increase, since the leakage current through the capacitor is zero. To simplify the conclusions, we agree that the leakage resistance of both wires is the same, i.e. r1 = r2 = r. The expression for the current flowing through a person, obtained from an equivalent circuit (Figure 3.15, b), looks like:

$$I_ч = U/(r + 2R_ч) .$$

Touching a person with an ungrounded network wire with a grounded pole (Figure 5.10, c) causes current flow $I_ч = U/(R_ч + R_0)$,

Since R0 << Rh, we can write that $I_ч = U/R_ч$.

Touching a good wire when another wire is connected to the ground (Figure 5.10, d) causes current through the person:

$$I_ч = U/(R_ч + R_к)\ .$$

When you touch one of the wires of a network with a grounded midpoint (Figure 3.15, e), a person falls under a voltage equal to half the mains voltage:

$$I_ч = U\ /2(R_ч + R_з),$$

where R3 is the closure resistance. In case of contact with two wires of the network (Fig. 3.15, e), the person falls under the mains voltage and the current expression will be:

$$I_ч = U\ /R_ч$$

Analyzing these expressions for currents passing through a person in different cases of touching single-phase direct current networks, we can conclude that the most dangerous is the bipolar contact in any network mode with respect to ground (isolated, grounded pole or midpoint), since in this case The current flowing through the person is determined only by the resistance of his body. The least dangerous is a single-pole contact to an insulated network wire in normal operation.

Thermal action consists in heating tissues and biological media of the body, which leads to overheating of the whole organism and, as a consequence, to the disturbance of metabolic processes and associated deviations.

Electrolytic action is the decomposition of blood, plasma and other physiological solutions of the body, after which they can no longer perform their functions. Biological effects are associated with irritation and excitation of nerve fibers and other organs. There are two main types of electric shock: electric injuries and impacts.

Electro-injuries include:

• electric burn - the result of the thermal effect of electric current in the place of contact;

• electric sign - a specific lesion of the skin, expressed in the solidification and necrosis of the upper layer;

• Metallization of the skin - the introduction into the skin of the smallest particles of metal;

• electrophthalmia - inflammation of the outer shells of the eye due to the action of ultraviolet radiation from the arc;

• mechanical damage caused by involuntary contractions of muscles under the influence of current.

An electric shock is the destruction of the body by an electric current, in which the excitation of living tissues is accompanied by a convulsive contraction of the muscles

Depending on the arising consequences, electric shocks are divided into four stages:

• I - convulsive muscle contraction without losing consciousness;

• II - convulsive muscle contraction with loss of consciousness, but with preserved breathing and work of the heart;

• III - loss of consciousness and violation of heart activity or breathing (or both);

• IV - the state of clinical death.

The severity of electric shock depends on many factors:

• current,

• electrical resistance of the human body,

• duration of current flow through the body,

• type and frequency of current,

• individual properties of a person,

• environmental conditions.

The main factor responsible for this or that degree of human injury is the strength of the current. To characterize its impact on humans, three criteria are established:

• Threshold sensible current - the lowest value of the current causing significant irritations;

• Threshold unblocking current - current value, causing convulsive muscle contractions, which do not allow the affected person to get rid of the source of the attack;

• threshold fibrillation current - current value, which causes fibrillation of the heart.

Fibrillation refers to chaotic and non-simultaneous contractions of the fibers of the heart muscle, completely violating its work.

The outcome of the defeat is strongly influenced by the resistance of the human body. The greatest resistance (3 ... 20 kOhm) has an upper layer of skin (0.2 mm), consisting of dead keratinized cells, whereas the resistance of cerebrospinal fluid is 0.5 ... 0.6 Ohm. The total resistance of the body due to the resistance of the upper layer of the skin is large enough, but as soon as this layer is damaged - its value drops sharply.

In calculations related to electrical safety, the resistance of the human body is taken to be 1 kOhm. The duration of the action of the current significantly affects the outcome of the lesion, as the resistance of the human skin drops sharply over time, the heart lesion becomes more likely and other negative consequences occur. The most dangerous passage of current through the heart, lungs and brain. The degree of damage also depends on the kind and frequency of the current. The most dangerous alternating current frequency is 20 ... 1000 Hz. An alternating current is more dangerous than a constant current at voltages up to 300 V. For high voltages, there is a constant current.

Electric shock can occur in the following cases:

• touching a person not insulated from the ground to live parts of electrical installations under voltage;

• approaching a person who is not insulated from the ground, at a dangerous distance to current-carrying unprotected insulation parts of electrical installations. The latter are under tension;

• touching a person who is not insulated from the ground to non-conductive metal parts (housings) of electrical installations that are under voltage due to a short to the case;

• contact of a person with two points of the earth (floor), located at different potentials in the field of current flow ("step voltage");

• lightning strike;

• the action of the electric arc;

• release another person who is under stress.

Protective means used in electrical installations In the process of operating electrical installations, conditions often arise in which even the most perfect performance of them does not ensure the safety of the worker and requires the use of special protective equipment. For example, when working near current-carrying live parts, there is a danger of touching these parts and therefore special insulation of the tool and the worker is required. When working on disconnected live parts - tires, wires, etc.

there is a danger of accidental stress on them, therefore, measures must be taken to avoid erroneous supply of voltage to the work site and at the same time eliminate the danger of electric shock to workers who operate the electrical installation under voltage. Such protective devices supplementing stationary structural protective devices of electrical installations are so-called protective means - portable devices and devices that serve to protect personnel working in electric installations from electric shock and from exposure to electric arc and combustion products. Protective devices are divided into three groups: insulating, enclosing and auxiliary. Isolating protective devices are divided into basic and additional. The main insulating protective devices are capable of withstanding the operating voltage of the electrical installation for a long time and therefore they are allowed to touch live parts and are working under pressure. Such facilities include: in electrical installations with voltages up to 1000 V - dielectric rubber gloves, tools with insulated handles and current detectors; in electrical installations with voltages above 1000 V, insulating rods, insulating and current clamps, as well as high voltage indicators. Additional insulating protective devices have insufficient electrical strength and therefore can not protect the person from electric shock by themselves. Their purpose is to strengthen the protective effect of the main isolating means, with which they must be applied. Additional insulating protective means include: in electrical installations with voltages up to 1000 V - dielectric galoshes, rugs and insulating stands; in electrical installations with voltages above 1000 V - dielectric gloves, bots, mats and insulating stands.

Isolation rods are designed to disable and switch single-pole disconnectors, for applying portable grounding and other operations. Isolating pliers are used for maintenance of live voltage tube fuses. The current clamp is a portable device, it serves to measure the current flowing in a wire, cable, etc. The high voltage indicator and current detectors are used to check the presence or absence of voltage on current-carrying parts of electrical installations with voltages above 1000 V and up to 1000 V, respectively.

Rubber dielectric gloves, galoshes, bots and mats, as additional protective equipment, are used in operations performed with the help of basic protective equipment. In addition, gloves are used as the main protective means when working under voltage up to 1000 V, and galoshes and bots are used as a means of protection against step voltage. Insulating stands are used as an insulating base. The montage tool with insulated handles is used for work under voltage in electrical installations up to 1000 V.

Protective means are designed: for temporary fencing of current-carrying parts (temporary portable fences - shields, enclosure-cages, insulating covers, insulating hoods); to prevent erroneous operations (warning posters); for the temporary earthing of disconnected live parts in order to eliminate the risk of damage to the operating current with accidental occurrence of voltage (temporary protective earths). Auxiliary protective means are designed for individual protection of the light, thermal and mechanical effects. These include goggles, gas masks, special mittens, etc.

The integrity of the protective equipment should be checked by inspection before each use, and periodically after 6-12 months. Insulating protective equipment, as well as linings and caps, are periodically subjected to electrical tests. Experience shows that in order to ensure safe, accident-free and high-performance operation of electrical installations, along with their perfect performance and equipping with protective means, it is necessary to organize their operation in such a way as to exclude any possibility of errors on the part of maintenance personnel. The structure of the organization of operation is developed as a result of long experience of work of set of electroinstallations and is approved in the form of Rules of technical operation of electroinstallations

The basis for the organization of safe operation of electrical installations is high technical literacy and a conscious discipline of maintenance personnel, which is obliged to strictly observe organizational and technical measures, as well as methods and order of execution of operational operations in accordance with the Rules. The personnel providing normal operation of electrical installations are conventionally divided into three groups:

1) operational personnel - on-duty electrical personnel who are on duty in electrical installations directly or at home; his duty is to provide prompt service to the operating electrical installation;

2) repair personnel - persons performing repair, installation, adjustment, construction and similar work in electrical installations; they can have different qualifications - electrical engineering, construction, etc., and be both employees of this economy, and employees of outside organizations and services;

3) operational and repair personnel - persons of electrical engineering qualification, who are charged with the operational maintenance of electrical installations that do not have on-duty personnel, as well as the production of work in these installations; Thus, these persons can perform all the functions of operational and repair personnel in the installations assigned to them, with the exception of the watch, which

is not maintained in these installations; they are workers of the given economy. Body check. Persons serving electrical installations should not have injuries and illnesses that interfere with production work.

For personnel taking direct part in operational switching and repair work in electrical installations, the health status is established by medical examination during employment, and then periodically every two years, and for persons working with mercury rectifiers - once a year.
Training and qualification. Each employee before the appointment of his independent work on electrical installations or when transferring to another job site must be trained in safe working methods at the workplace and testing knowledge.

Training in the workplace A new employee is supervised by an experienced worker who is responsible for the quality of such training. At the same time, he is obliged to study safety rules, rules for the provision of first aid, etc., in an amount corresponding to the requirements of his workplace. The knowledge of the Safety Regulations is checked by the Qualification Commission after training at the workplace. In this case, the auditee is assigned the qualification group corresponding to his / her knowledge and work experience in the field of safety engineering and issues a special personal identification certificate. In total there are five qualifying groups (I - V). The operation of the existing plant in terms of safety precautions is divided into two parts: a) operational maintenance of the electrical installation; b) production of works in the electrical installation. Operational maintenance of existing electrical installations includes: duty in electrical installations, inspections and inspections of electrical installations, operational switching, the performance of some minor works, as specified in the safety regulations, as part of routine maintenance.

Under the production of works is understood the performance of repair, installation, construction and other works in the existing electrical installation. In comparison with the above-mentioned small works performed in the order of current operation, these; work is more labor-intensive and requires a much more complex work organization to ensure safe and trouble-free working conditions. All works are carried out with the obligatory observance of the following conditions:

a) the work must be issued a permit authorized by that person (outfit, verbal or telephone order);

b) the work must, as a rule, be carried out by at least two persons;

c) organizational and technical measures ensuring the safety of personnel must be carried out.

The basic requirements for the installation of electrical installations are set out in the current "Rules for the installation of electrical installations." Electric installations are understood to be a set of machines, apparatus, lines and auxiliary equipment (together with the premises in which they are installed) intended for the production, transmission, distribution and conversion of electrical energy. They are divided into electrical installations up to 1000 V and more than 1000 V, both of which can be operated in networks with isolated and earthed neutral.

An isolated neutral is the neutral of a transformer or generator that is not connected to the grounding device or connected to it through signaling, protection, monitoring devices, etc.

If the neutral is connected to the grounding device directly or through a small resistance, it is called grounded. Depending on the conditions that increase or decrease the risk of electric shock to an individual, all premises are divided into rooms with increased danger, especially dangerous and without increased danger.

To rooms with increased danger include rooms with high humidity (more than 75%) or high temperature (above 35 ° C). In the presence of conductive dust and floors, and also with the possibility of simultaneous contact with elements connected to the ground and the metal housings of electrical equipment, the room is classified as an increased danger class. Premises with high relative humidity (close to 100%), a chemically active medium or simultaneous presence of two or more conditions corresponding to rooms with increased danger, are called especially dangerous.

In rooms without increased risk there are no all the above conditions However, the danger of electric shock exists everywhere, where electrical installations are used, therefore rooms without increased danger can not be called safe. Particularly dangerous are mechanical, foundry, forging, assembly, galvanic, thermal, etc. shops, compressor and water pump stations, rooms for charging batteries, etc. By the degree of danger, electrical installations outside the premises are equated with electrical installations operating in especially dangerous premises.

When working in electrical installations use:

• means of protection against electric shock (electric protective equipment);

• Collective and individual means of protection against electric fields of increased tension (in electrical installations with a voltage of 330 kV and above);

• personal protective equipment (PPE): heads (protective helmets); eyes and face (goggles and shields); respiratory organs (gas masks and respirators); hands (mittens); from falling from height (safety belts and safety ropes); special protective clothing (kits for protection against electric arc).

Electro-protective means are designed to protect people in the maintenance of electrical installations. In accordance with the Instruction for the application and testing of protective equipment used in electrical installations, they are divided into:

• Isolating (basic and additional);

• enclosing;

• auxiliary.

Isolating electro-protective means (Figure 5.15) serve to isolate a person from live parts and earth. They are divided into basic and additional.

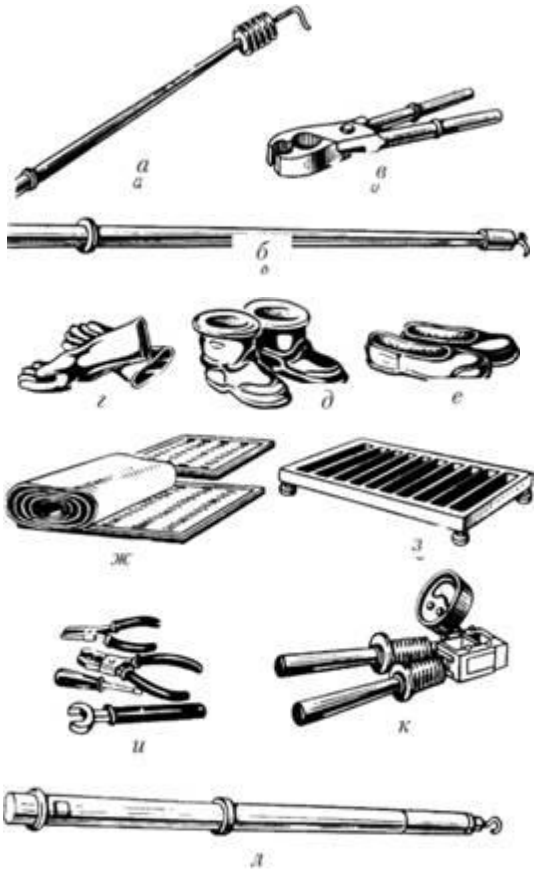


Fig. 5.15. Insulating protective means: a, b - insulating rods; c - insulating pliers; d - dielectric gloves; d - dielectric bots; e - dielectric galoshes; ж - rubber mats and paths; 3 - insulating stand; and - tools with insulating handles; k - current clamp; l - voltage indicator

Isolation of the main insulating means withstands the full operating voltage of electrical installations, and they are allowed to touch current-carrying live parts. Additional means can not independently ensure the safety of maintenance personnel and they are used in conjunction with basic means to enhance protective action.

Isolating protective means

The main insulating electro-protective means for electrical installations with voltages above 1000 V are:

• insulating rods of all kinds;

• isolating pliers;

• voltage indicators;

• Devices and devices for ensuring the safety of work in measurements and tests in electrical installations (voltage indicators for checking the coincidence of phases, electrical clamps, puncture devices, etc.);

• special protective equipment, devices and insulating devices for work under voltage in electrical installations with a voltage of 110 kV and higher (except for the rods for transfer and equalization of the potential).

To additional insulating electro-protective means for electrical installations with voltages above 1000 V are:

- Dielectric gloves and bots;
- Dielectric carpets and insulating stands;
- insulating hoods and covers;
- rods for carrying and equalizing the potential;
- ladders ladders, ladders insulating fiberglass.

The main insulating electro-protective means for electrical installations with voltages up to 1000 V are:

- insulating rods of all kinds;
- isolating pliers;
- voltage indicators;
- electrical clamps;
- Dielectric gloves;
- manual insulating tool.

To additional insulating electro-protective means for electrical installations with voltages up to 1000 V are:

• dielectric galoshes;

• Dielectric carpets and insulating stands;

• insulating hoods, covers and lining;

• ladders ladders, ladders insulating fiberglass.

Means of protection from electric fields of increased tension (in electrical installations with voltage of 330 kV and above) include individual shielding kits for working on the potential of an overhead power transmission line (OL) and ground potential in an open switchgear and on overhead lines, as well as removable and portable shielding devices and safety posters.

When using the basic insulating electroprotective means, it is sufficient to use one additional, except for specially stipulated cases. If necessary, it is possible to protect dielectric bots or galoshes from the step voltage without using basic protection. Protective means of protection (shields, enclosures-cages, insulating lining, etc.) are designed for temporary fencing of current-carrying parts. Auxiliary means of protection (safety belts, safety ropes, claws, goggles, mittens, cloth suits, etc.) serve to protect against accidental falls from height, as well as from light, thermal, mechanical and chemical influences of electric current.

Personnel who conduct work in electrical installations must be provided with all necessary means of protection in accordance with the standards of equipment, trained in the rules for their use and must use them. Only protective equipment marked with the manufacturer's name, name or type of product and the year of its production, as well as a stamp on their testing, should be used for work. Isolating electro-protective means are designed for use in closed electrical installations, and in open electrical installations - only in dry weather. It is not allowed to use them in drizzle and rainfall. In the open air in wet weather, only special protective equipment designed to work in such conditions can be used. Inventory means of protection are distributed between the objects (electrical installations) and between the visiting brigades in accordance with the system adopted by the enterprise, as well as taking into account the recruitment standards established by the IPIS. Such distribution is recorded in the lists approved by the technical manager of the organization or by the employee responsible for the electric economy. They also indicate the places of storage of the issued remedies. Employees who received protection means for individual use are responsible for their proper operation and timely monitoring of their condition. A protective shutdown is a device that quickly (no more than 0.2 s) automatically cuts off the electrical network if there is a danger of electric shock in the person.

Such a danger can arise, in particular, when the phase is closed on the body of electrical equipment; with a decrease in the insulation resistance of phases relative to the ground below a certain limit; When a higher voltage appears in the network; when a person touches a current-carrying part that is under tension.

In these cases, some electrical parameters change in the network; for example, the voltage of the housing relative to the ground, the earth fault current, the phase voltage relative to the earth, the zero sequence voltage, etc. can change. Any of these parameters, or more precisely, its change to a certain limit, at which there is a risk of human injury by current, can serve an impulse triggering the tripping of a protective device, i.e., the automatic shutdown of a dangerous section of the network.

The main parts of the residual current device are a residual current device and a circuit breaker. The device of protective switching-off is a set of separate elements which react to change of any parameter of an electric network and give a signal on switching-off of the automatic switch. These elements are: a sensor is a device that senses a change in a parameter and converts it into an appropriate signal. As a rule, relays of the corresponding types serve as sensors; An amplifier designed to amplify the sensor signal if it is not powerful enough; control circuits serving for periodic verification of the integrity of the circuit of the protective-tripping device; auxiliary elements - signal lamps, measuring devices (for example, an ohmmeter), characterizing the condition of the electrical installation, etc. A circuit breaker is a device used to turn on and off circuits under load and short circuits. It must disconnect the circuit automatically when a signal from the residual current device comes in. Types of devices. Each protective device according to the parameter to which it responds can be assigned to one type or another, including the types of devices that react to the voltage of the housing relative to the ground, the earth fault current, the phase voltage relative to the ground, zero sequence voltage, residual current, operational current, etc. Below, two types of such devices are considered as an example.

Protect tripping devices that react to the voltage of the housing relative to the ground, have the function of eliminating the risk of electric shock when an overvoltage or earthed housing arises. These devices are an additional measure of protection to earth or zero.

The principle of operation is a quick disconnection from the installation network, if the voltage of its housing relative to the ground is higher than a certain maximum permissible value U.degree, as a result of which the touch to the housing becomes dangerous. A schematic diagram of such a device is shown in Fig. 3.12. Here, the sensor is a maximum voltage relay connected between the protected housing and the auxiliary earthing switch RB directly or via a voltage transformer. The electrodes of the auxiliary earthing switch are located in the zone of zero potential, i.e., no closer than 15-20 m from the earth electrode of the housing R3 or earth conductors of the neutral wire.

In case of a phase failure on a grounded or zeroed case, the protective property of grounding (or zeroing) will first appear, due to which the voltage of the housing will be limited by some UK limit. Then, if UK is above the preset maximum permissible voltage U.d., a protective-tripping device is triggered, i.e. the maximum voltage relay closes the contacts, supplies power to the tripping coil, and thus causes the installation to be disconnected from the mains.

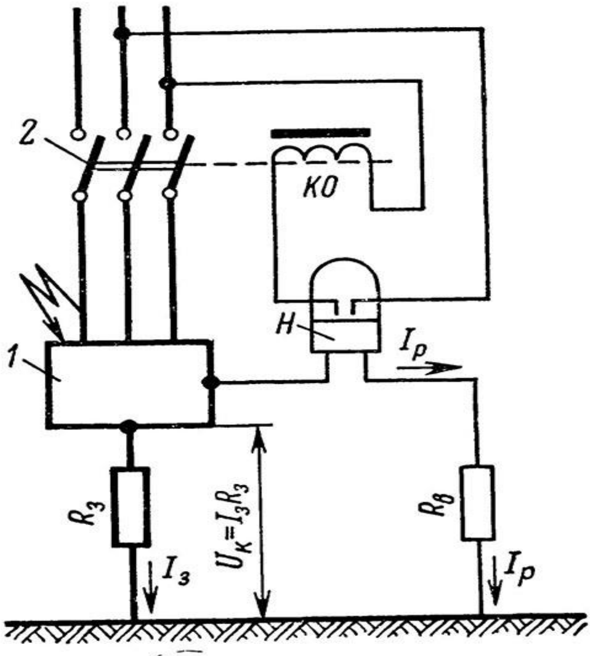


Fig. 5.12. Schematic diagram of a protective-disconnecting device that reacts to the voltage of the housing relative to the ground: 1 - housing; 2 - automatic switch; BUT - a tripping coil; H - voltage relay

maximum; R3 - protective earthing resistance; RB - resistance of auxiliary earthing

The use of this type of protective switch-off device is limited to installations with individual grounding. Protective-disconnecting devices reacting to real-time direct current are designed for continuous automatic monitoring of network isolation, as well as for protecting the person who touched the current-carrying part from electric shock.

In these devices, the insulation resistance of the wires to the ground is estimated by the magnitude of the DC current passing through these resistances and obtained from an extraneous source. If the insulation resistance of wires is reduced below a certain predetermined limit, as a result of damage or touch of a person to the wire, the DC current will increase and cause the corresponding section to turn off.

A schematic diagram of this device is shown in Fig. 5.13. The sensor is a current relay T with a low operating current (several milliamperes). Three-phase choke - transformer DT is designed to obtain the zero point of the network. A single-phase throttle D limits the leakage of an alternating current to the ground to which it has a large inductive resistance.

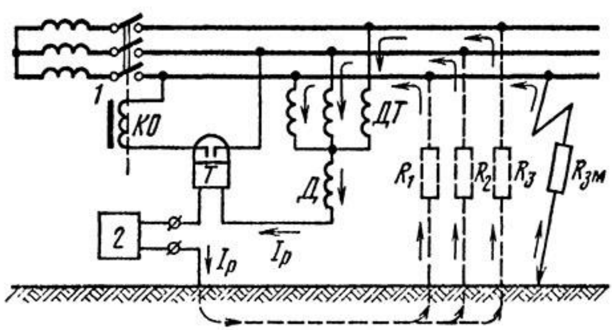


Fig. 5.13. Schematic diagram of a protective-disconnecting device responsive to an operative direct current: 1 - the automatic switch;
2 - constant current source; KO - breaker tripping coil; ДТ - a three-phase reactor; D - single-phase choke; T - the relay of a current; R1, R2, R3 - insulation resistance of phases relative to ground; Ram - phase-to-earth resistance

The DC current Ip, obtained from an external source, flows through a closed circuit: source-ground-insulation resistance of all wires relative to ground-wires-three-phase reactor DT - single-phase reactor D-current coil of current relay T-current source.

\he value of this current (A) depends on the voltage of the constant current source Uist and the total resistance of the circuit:

$$I_р = \frac{U_{ист}}{R_Д + R_э},$$

where Rд - total resistance of the relay and throttles, Ohm; Ra - total insulation resistance of the wires R1, R2, R3 and phase-to-ground R3M.

Under normal operation of the network, the resistance Rd is large, and therefore the current Ip is insignificant. In the case of reducing the insulation resistance of one (or two, three phases) due to the phase closure to the ground or to the housing, or as a result of contact with the human phase, the resistance R e decreases, and the current Ip increases and, if it exceeds the relay tripping current, network from the power source. The area of application of these devices is a small network of voltages up to 1000 V with isolated neutral.

Fig. 5.13. Device trench installation of vertical electrodes

Protective earthing - deliberate connection to the ground of metal parts of equipment that are not energized under normal conditions, but which may be energized as a result of a violation of the insulation of the electrical installation. The purpose of protective earthing is to eliminate the danger of electric shock to people with the appearance of voltage on the structural parts of the electrical equipment, i.e., in case of a "short to the case". The principle of protective earthing is a reduction to safe values of touch and pitch voltages caused by a "short to the body".

This is achieved by reducing the potential of grounded equipment, as well as equalizing potentials by raising the potential of the base on which the person stands, to a potential close to the potential of grounded equipment. The protective grounding area is three-phase three-wire networks with voltages up to 1000 V with isolated neutral and above 1000 V with any neutral mode (Figure 5.14).

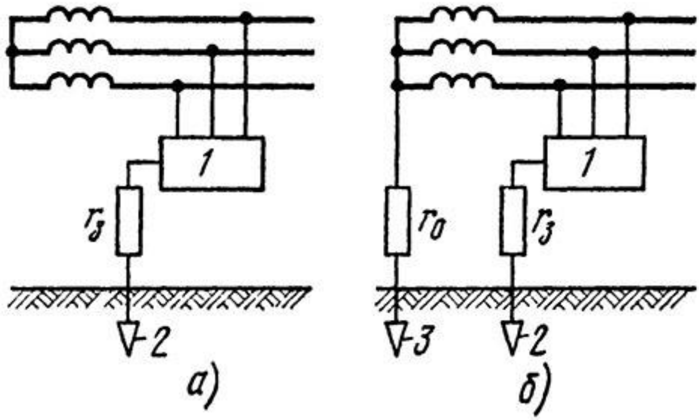


Fig. 5.14. Principles of protective earthing: a - in a network with isolated neutral up to 1000 V and higher; b - in a network with a grounded neutral above 1000 V, 1 - grounded equipment; 2 - protective grounding conductor; 3 - earthing conductor; r3. ro - resistance, respectively, of protective and working grounding

Types of grounding devices. A grounding device is a combination of a grounding conductor - metal conductors in direct contact with the ground and grounding conductors connecting the grounded parts of the electrical installation to the earthing switch. There are two types of grounding devices: remote (or concentrated) and contour (or distributed).

The remote grounding device is characterized by the fact that the earth electrode is carried out beyond the site on which the grounded equipment is located, or is concentrated on some part of this site. The disadvantage of remote grounding is the remoteness of the earthing switch from the protected equipment, so the touch factor is a = 1. Therefore, this type of grounding is used only at low earth fault currents and, in particular, in installations up to 1000 V, where the potential of the earthing switch does not exceed the permissible contact voltage .

The advantage of this type of grounding device is the possibility of choosing the location of electrodes with the lowest resistance of the soil (wet, clay, in lowlands, etc.). A loop grounding device is characterized in that its single earth conductors are placed along the contour (perimeter) of the site on which the grounded equipment is located, or distributed throughout the site as evenly as possible. Safety for loop grounding is ensured by equalizing the potential in the protected area to such a value that the maximum values of contact and step voltage do not exceed the permissible values.

This is achieved by the appropriate placement of single earth conductors. Indoors, the potential equalization occurs naturally through metal structures, pipelines, cables and similar conductive objects associated with a branched ground network. Execution of grounding devices. There are artificial earthing switches, intended solely for grounding purposes, and natural - metal objects of other purposes located in the ground.

For artificial earthing switches, vertical and horizontal electrodes are usually used. As vertical electrodes, steel pipes 3-5 cm in diameter and angular steel from 40 X 40 to 60 X 60 mm in length 2.5-3 m are used. In recent years, steel bars with a diameter of 10-12 mm and a length of up to 10 m have been used. For the connection of vertical electrodes and as a separate horizontal electrode, strip steel with a cross section of at least 4 X 12 mm or a round steel with a diameter of at least 6 mm is used. For installation of vertical earthing conductors, a trench depth of 0.7-0.8 m is pre-cut, after which pipes or corners are clogged with mechanisms. As natural grounders, it is possible to use: water pipes and other metal pipelines laid in the ground, with the exception of pipelines of flammable liquids, flammable or explosive gases, and pipelines covered with insulation for protection against corrosion; casing pipes of artesian wells, boreholes, pits, etc.; metal structures and reinforcement of reinforced concrete structures of buildings and structures that have a connection to the ground; Lead casing of cables laid in the ground. As a rule, natural earth conductors have a low resistance to current flow and, therefore, their use for grounding provides very tangible savings.

Disadvantages of natural grounders are the availability of their non-electrical personnel and the possibility of disrupting the continuity of the connection of extended earthing switches (for repair work, etc.). As grounding conductors intended to connect the grounding parts to the earthing switches, strip steel, as well as round steel, etc., are usually used. The earthing conductors are laid openly in the constructions of buildings, including on walls on special supports. Earthing conductors in the premises should be available for inspection.

The connection of the grounded equipment to the earthing main is carried out by means of separate conductors. In this case, the serial switching on of grounded equipment is not allowed. According to the requirements of the Rules for the installation of electrical installations, the protective earthing resistance at any time of the year should not exceed:

4 Ohm - in installations with voltage up to 1000 V; if the power of the current source (generator or transformer) is less than 100 kVA, then the ground resistance is allowed to be 10 Ω; 0.5 Ohm - in installations with voltages above 1000 V with large ground fault currents (greater than 500 A);

250 / I3, but not more than 10 Ohm - in installations with voltages above 1000 V with low earth fault currents and without compensation of capacitive currents; If the grounding device is simultaneously used for electrical installations with voltages up to 1000 V, the grounding resistance should not exceed 125 / I3, but not more than 10 Ohm (or 4 Ohm, if this is required for installations up to 1000 V). Here I3 is the earth fault current.

Equipment to be grounded. Protective grounding is subject to metal non-conductive parts of electrical equipment, which, due to failure of insulation, may be energized, and to which people and animals may be touched. In this case, in areas with increased danger or especially dangerous grounding is mandatory at a rated voltage of the electrical installation above 36 V AC and 110 V DC, and in rooms without increased danger - at a voltage of 500 V and above. Only in explosive areas, grounding is carried out regardless of the voltage.

Zanjeniem is the connection to cores and other structural metal parts of electrical equipment, which are normally not under voltage, connected to the grounded zero wire of the power supply network, but can be energized due to damage to the insulation. The basic scheme of zeroing is shown in Fig. 5.15. The task of zeroing is the same as the protective grounding: the elimination of the danger of human injury by a current in case of breakdown on the case. This task is solved by automatic disconnection of the damaged installation from the network.

The principle of zero-point operation is the transformation of the breakdown into a single-phase short-circuit (i.e., a short-circuit between the phase and neutral conductors) in order to create a large current capable of triggering protection and thereby automatically disconnect the damaged installation from the mains. Such protection is: fuses or circuit breakers installed in front of consumers of energy to protect against short-circuit currents. The speed of disconnection of the damaged installation, i.e., the time from the appearance of the voltage on the housing to the moment when the installation is disconnected from the mains power supply, is 5-7 seconds when the fuse is protected by the fuse and 1-2 seconds when protected by automatic devices.

The purpose of the zero wire is to create a short circuit for the short-circuit current with a low resistance, so that this current is sufficient to quickly activate the protection, i.e., quickly disconnecting the damaged installation from the network. For example, consider the following case. Suppose we have a circuit without a null wire, whose role is played by the earth (Figure 5.15). Will such a scheme work? When the phase is closed to the body, a current (A) flows through the circuit formed through the ground:

$$I_з = \frac{U_Ф}{R_з + R_0},$$

so that a stress is produced on the body relative to the ground (B)

$$U_к = I_з R_з = U_ф \frac{R_з}{R_з + R_0},$$

where Uph is the phase voltage, V; R0, R3 - neutral and housing grounding resistance, Ohm.

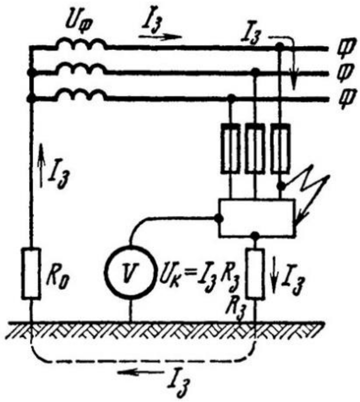


Fig. 73. On the issue of the necessity of a zero wire in a three-phase network up to 1000 V with a grounded neutral

Resistance of the transformer winding and network wires are small compared to R0 and R3 and therefore are not taken into account. Current 13 may not be sufficient to trigger protection, i.e., the equipment may not shut down. For example, with Uf == 220 V and R3 = R0 = 4 Ohm, we get

$$I_з = \frac{220}{4+4} = 27{,}5 \text{ A};$$

$$U_к = 220\frac{4}{4+4} = 110 \text{ B}.$$

If the overcurrent protection current is greater than 27.5 A, the trip will not occur and the enclosure will remain live until the installation is manually disconnected. Certainly, that at the same time there is a threat of electric shock to people in case of touching the damaged equipment. To eliminate this danger, it is necessary to increase the current flowing through the protection, which is achieved by introducing a zero wire into the circuit. According to the requirements of the Electrical Installation Rules, the neutral wire must have a conductivity of not less than half the conductivity of the phase conductor. In this case, the short-circuit current will be sufficient to quickly turn off the damaged installation.

From what has been said, we can conclude: in a three-phase network with a voltage of up to 1000 V with a grounded neutral without a zero wire, it is impossible to ensure safety when the phase is closed to the housing, so it is forbidden to use such a network. The purpose of neutral grounding is to reduce to a safe value the voltage relative to ground of the neutral wire (and all enclosures connected to it) with an accidental phase closure to ground.

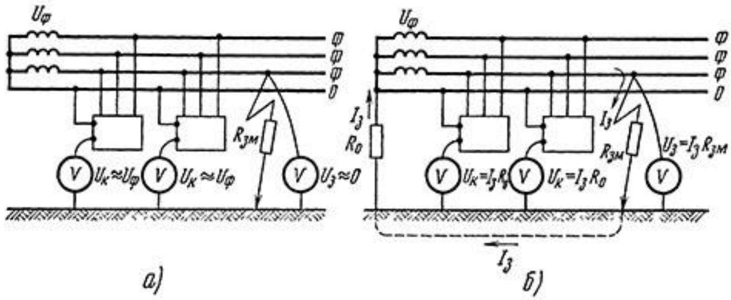


Fig. 5.16. The case of a phase-to-earth fault in a three-phase four-wire network up to 1000 V with an isolated (a) and earthed (b) neutral

In fact, in a four-wire network with an isolated neutral in the event of a random phase-to-earth connection (Fig. 15.16, a), a voltage appears close to the phase voltage of the network Uf, which is close to the phase voltage of the network Uf, which will exist before the entire network is turned off manually or until elimination of the closure. Of course, this is very dangerous.

In a network with a grounded neutral with such damage, there will be a completely different, practically safe position (Fig. 15.16, b). In this case, Uf will be divided in proportion to the resistance Ram (phase-to-earth resistance) and R0 (neutral grounding resistance), so that the voltage between the zeroed equipment and ground will drop sharply and equal (B):

$$U_к = I_з R_0 = U_ф \frac{R_0}{R_0 + R_{зм}}.$$

Typically, the resistance to grounding due to a random grounding of the wire to the ground, that is, Rm is many times larger than R0, therefore, UH is insignificant. For example, with Uf = 220 V, R0 = 4 Ohm and Rzm = 100 Ohm, we get

$$U_к = 220 \frac{4}{4+100} = 8{,}5 \text{ В}.$$

With this voltage, touching the case is not dangerous.

Consequently, a three-phase four-wire network with isolated neutral encloses a risk of electric shock and should therefore not be used. According to the instructions of the Electrical Installation Rules, the grounding resistance of the neutral must not be more than 4 ohms. Only for low-power current sources up to 100 kVA (or 100 kW), the grounding resistance of the neutral can reach 10 Ohm.

The purpose of re-earthing the neutral wire is to reduce the risk of people injuring the current that occurs when the neutral wire breaks off and the phase closes on the case behind the breakage site. In fact, if the neutral wire breaks accidentally and the phase closes on the case (behind the breakage point), the absence of a re-grounding will result in the voltage relative to the ground of the ragged section of the zero wire and all the enclosures connected to it equal to the phase voltage of the network Uph (Fig.15.16, a).

This voltage, which is definitely dangerous for a person, will exist for a long time, as the damaged installation will not automatically shut down and it will be difficult to detect it to be turned off manually.

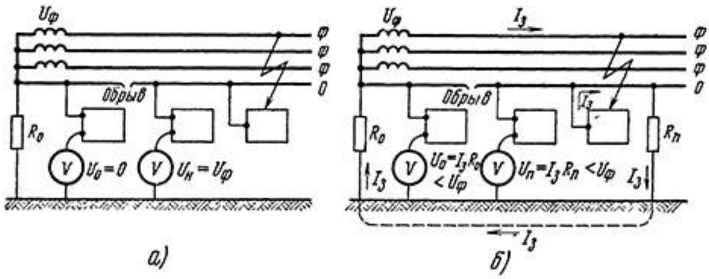


Fig. 15.17. The case of phase closure on the case with a break in the neutral wire: a - in the network without re-grounding the neutral wire; b - in the network with the repeated earthing of the neutral wire

If the neutral wire is re-grounded, if it breaks, the current circuit I3 through the ground will remain (Fig. 75, b), so that the voltage (V) of the zeroed enclosures located behind the cutoff point will decrease to the value:

$$U_{н} = I_{з} R_{п} = U_{ф} \frac{R_{п}}{R_{0} + R_{п}},$$

where Rn is the resistance of re-grounding of the zero wire, Ohm. However, the hulls connected to the zero wire up to the break point will also be under voltage (V) relative to the ground, which will be:

$$U_0 = I_з R_0 = U_ф \frac{R_0}{R_0 + R_п}.$$

Together, these voltages are equal to the phase voltage: $U_н + U_0 = U_ф.$

If Rn = R0, the enclosures connected to the zero wire both before and after the break point will have the same voltage: UH = U0 =0,5Uф

This case is the least dangerous, since for other ratios of Ru and R0 the part of the shells will be under voltage, greater than 0.5 Uf. Consequently, re-grounding significantly reduces the risk of electric shock that occurs as a result of a break in the neutral wire, but can not eliminate it completely, that is, it can not provide the safety conditions that existed before the break.

In this connection, a careful laying of the zero wire is required in order to exclude the possibility of its breaking off for any reason. Therefore, in the neutral wire it is forbidden to put fuses, knife switches and other devices that can disrupt its integrity. According to the requirements of the Electrical Installation Rules, the resistance of re-grounding of the neutral wire must not exceed 10 Ohm; Only in networks powered by 100 kVA or less transformers (or generators with a power of 100 kW or less), the resistance of each re-grounding can reach 30 ohms, provided that in this network the number of repeated earths is at least three.

Zoning is subject to the same metallic structural non-current parts of electrical equipment that are subject to protective earthing: the body of machines and apparatus, tanks of transformers, The touch voltage (Fig. 15.17) is the voltage between two points of the earth fault circuit (housing), while the person is touched at the same time. Numerically, it is equal to the difference in the potentials of the hull and the ground points in which

the human legs are located: where is the specific resistance of the soil;
r - radius of the conditional hemispherical earthing switch; Contact stress factor. Within the spreading zone, the current is less than one, and outside this zone is equal to one. The contact voltage increases as you move away from the earth electrode, and outside the current spreading zone it is equal to the voltage on the equipment case. The current flowing through the human body when touched,
.
The step voltage (Figure 15.16) is the potential difference due to the spreading of the earth fault current between the points of the current circuit that are at a distance a, which are simultaneously touched by the feet of a person.

Fig. 15.17. Scheme of occurrence of touch voltage and step voltage where bw is the step voltage coefficient. The step voltage depends on the potential of the earth fault and ground resistivity, as well as the

distance from the earthing switch and the step width. The step voltage is maximum at the earth electrode and decreases as you move away from the earth electrode; outside the spreading field it is zero. The current due to the step voltage,

Safe current. A current should be considered permissible, in which a person can independently release himself from the electrical circuit. Its value depends on the speed of current passing through the human body: with a duration of more than 10 s - 2 mA, and at 120 s and less - 6 mA. 36 V (for luminaires of local stationary lighting, portable luminaires, etc.) and 12 V (for portable luminaires when working inside metal tanks, boilers) are considered safe voltage. But under certain situations, such stresses can be dangerous.

Safe voltage levels are obtained from the lighting network, using for this purpose step-down transformers. Spread the application of safe voltage to all electrical devices is impossible. In production processes, two types of current are used - permanent and alternating. They have different effects on the body at voltages up to 500 V. The risk of damage to the DC current is less than that of the alternating current. The greatest danger is represented by a current of 50 Hz, which is standard for domestic electrical networks. The way in which an electric current passes through the human body, largely determines the degree of damage to the body. The following variants of the directions of current flow along the human body are possible:

• a person touches live wires (parts of equipment) with both hands, in this case there is a direction of current flow from one hand to the other, i.e. "hand-arm", this loop occurs most often;

• when one hand touches the source, the current path closes through both legs to the ground "hand-legs";

• in case of breakdown of insulation of current-carrying parts of equipment on the body under tension, the hands of the working one are at the same time the flow of current from the equipment case to the ground leads to the fact that the legs are under tension, but with a different potential, thus the "hand-foot";

• When the current flows to the ground from faulty equipment, the ground receives a varying voltage potential nearby, and the person who stepped on both sides with such a foot is under the potential difference, that is, each of these legs receives a different voltage potential, resulting in a step voltage and electric chain "leg-foot", which happens least often and is considered the least dangerous;

• Touching the head to live parts can cause, depending on the nature of the work done, the current path to the hands or feet - "head-hands", "head-legs".

All options vary in degree of danger. The most dangerous are the options "head-arms", "head-legs", "hands-feet" (full loop). This is due to the fact that the vital system of the body - the brain, the heart - falls into the affected area.

The duration of the effect of the current affects the final outcome of the lesion. The longer the electric current is applied to the body, the heavier the consequences. mThe environmental conditions that surround a person during production activities can increase the risk of electric shock. Increase the risk of electric shock with increased temperature and humidity, metal or other conductive floor.

By the degree of danger of human injury, all rooms are divided into three classes: without increased danger, with increased danger, especially dangerous.

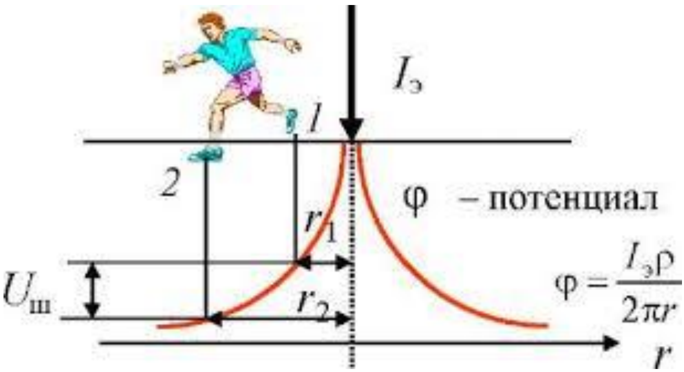


Fig. 3.10. Step voltage

First aid to an electric shock person

The first pre-medical help in case of accidents from electric current consists of two stages: the release of the victim from the action of the current and the provision of medical assistance to him / her. The release of the victim from the action of the current can be accomplished in several ways. The simplest and most reliable way is to disconnect the corresponding part of the electrical installation. If the trip can not be done quickly for some reason (for example, the switch is far away), at a voltage of up to 1000 V, cut the wires with an ax with a wooden handle or pull the victim away from the current carrying part, picking up his clothes, if it's dry, throw the wire away with a wooden stick, etc. For voltages above 1000 V, use dielectric gloves, bots and, if necessary, insulating rod or insulating mites. The first-aid measures for the victim of electric current depend on his condition.

If the victim is conscious, but before he has fainted or has been under a current for a long time, he needs to ensure full rest before the arrival of the doctor or urgently to deliver to a medical institution.

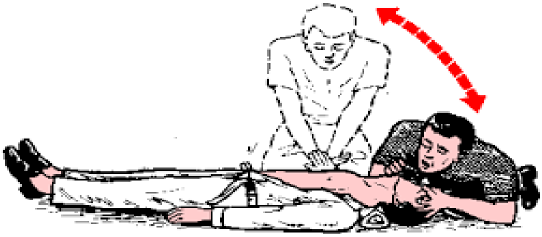


Fig. 5.18. Heart massage and artificial respiration.

In the absence of consciousness, but the remaining breath, it is necessary exactly and conveniently to lay the victim on a soft litter, unfasten the belt and clothes, to ensure the influx of fresh air. You should give sniff ammonia, sprinkle with water, rub and warm the body. In the absence of signs of life, one must do artificial respiration and cardiac massage. Artificial respiration should be started immediately after the victim is freed from the action of the current and the detection of his condition. It should be done by methods known as "from mouth to mouth" and "from mouth to nose".

These methods consist in the fact that the caregiver blows air from his lungs into the victim's lungs through his mouth or through his nose. It was found that the air exhaled from the lungs contains enough oxygen for breathing. With this method, the victim is laid on his back, open his mouth and remove foreign objects and mucus from his mouth. For the disclosure of the larynx, the person who is helping throws the victim's head back, putting one hand under his neck, and pressing the other hand on the forehead or the brim of the victim to such an extent that the chin is on the same line with the neck.

After that, the help person takes a deep breath and exhales forcefully into the victim's mouth. At the same time he should cover his mouth with the mouth of the victim and with his face pinch his nose (Figure 62, a). Then the relief man leans back and takes a new breath. During this period, the chest of the victim falls and he makes a passive exhalation (Figure 5.19, b) In one minute, you should do 10-12 blowing. Injection of air can be made through gauze, handkerchief or a special tube.

When the respirator resumes self-breathing for a while, it is necessary to continue artificial respiration until the victim is fully brought into consciousness, timing the injection to the beginning of the patient's own inhalation.

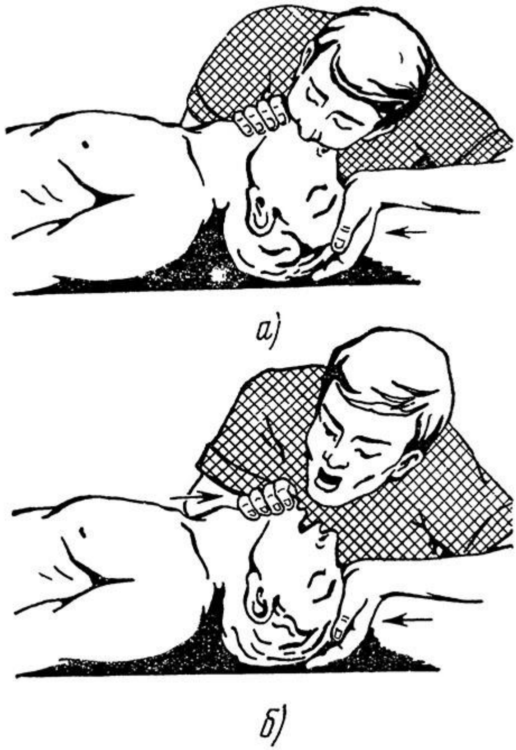


Fig. 5.19. Production of artificial respiration by the method "from mouth to mouth": a - inhalation; b – exhalation

External massage of the heart is intended to artificially maintain circulation in the body and restore the independent activity of the heart. Having determined by the palpation the pressure point, which should be about two fingers above the soft end of the sternum (Figure 5.20, a), the helper puts the lower part of the palm of one hand on it, and then puts the second hand at right angles at the right angle and presses on the breast the cell of the victim, slightly helping with the inclination of the whole body (Fig. 63, b). Press down should be about once a second with a quick jerk so as to move the lower part of the sternum down towards the spine for 3-4 cm, and for fat people - 5-6 cm. After a quick jerk, the hands remain in the achieved position for about 0.5 s. After that, the caregiver should straighten slightly and relax his arms, not taking them from his chest.

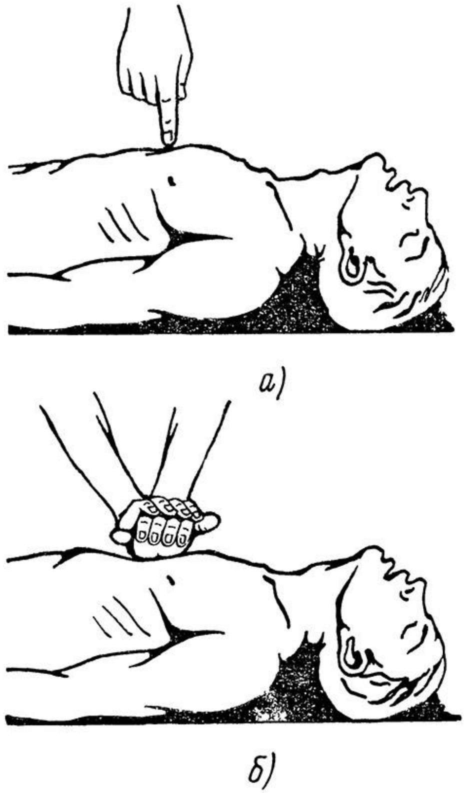


Fig. 5.21. External (indirect) cardiac massage: a - the place of pressure on the chest; b - the position of the hands when pressing on the chest

Simultaneously with heart massage, one must perform artificial respiration (injection). Inflammation should be made between the pressure or during a special pause every 4-5 strokes. If the assistance is provided by one person, he is obliged to alternate operations: after two blowing air to produce 15 pressure on the chest. The restoration of the heart from the victim is judged by the appearance of his own, not supported by a regular massage of the pulse. To check the pulse, you must interrupt the massage for 2-3 seconds.

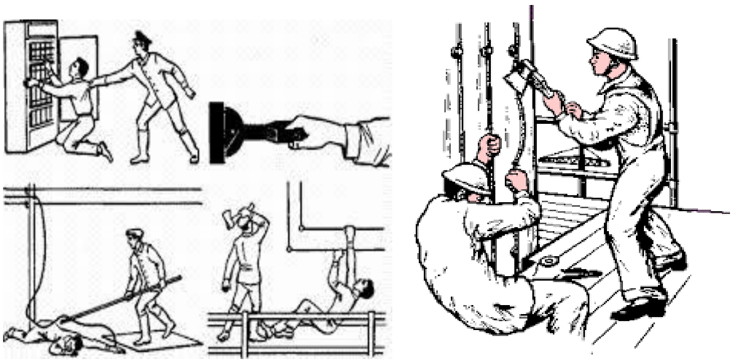


Fig. 5.21. Ways of getting rid of current electricity.

THEME 6.
BASICS OF SAFETY TECHNOLOGY IN THE SPHERE OF INFORMATION TECHNOLOGIES

Plan:

1. The concept of safety.
2. Fundamentals of security technology in the field of information technology.
3. Organization of a safety service.
4. Safety when working with optical devices.
5. Safety when working with power tools.
6. Trainings and training of employees in safe work methods.

Basic terms: *safety, safety, danger, danger zone, risk, barrier, blocking, fuses, signal, safety signs, information technology, communication, dangerous factor, telecommunications, globalization, international information resource, ergonomics, radiation, ion rays,* *dose radiation, "Luch" disease, dosimeter, causes of injuries, improvement of working conditions, production culture, preliminary instruction, production briefing.*

The concept of safety. Safety precautions are a system of organizational measures and technical means that prevent hazardous and harmful production factors from affecting employees. For each type of work there are certain safety rules, a person is allowed to work only after studying them. The passport of any technical device sets out the rules of operation, the performance of which makes it safe to work with this device. Ensuring safe working conditions is the responsibility of the administration.

Labor protection - a system of legislative acts, socio-economic, organizational, technical, hygienic and therapeutic and preventive measures and tools that ensure the safety, health and human performance in the labor process. Industrial sanitation is a system of organizational measures and technical means that prevent or reduce the impact on working harmful production factors.

The effectiveness of labor protection measures can be reduced by adverse environmental conditions in the industrial zone or urban environment. The problems of identification of the negative impact of production and technical means on the biosphere and technosphere, and the development and application of means to reduce this impact are solved by industrial ecology. The industrial ecology develops normative indicators of environmental friendliness of enterprises, equipment and transport, determines the procedure for environmental appraisal in the preparation of new productions and in the transition to new types of products.

In addition, the industrial ecology studies the impact of environmental conditions on the functioning of enterprises and their complexes. Preservation of the biosphere, ensuring safety and human health - the solution of these problems should be the goal of a specialist in any field of activity in the performance of professional duties.

Fig. 6.1. Safety Requirements for Workstations of Different Forms

The system of safety engineering design in enterprises and organizations

Hygienic assessment of the conditions and nature of work In accordance with the "Regulations on the Procedure for the Certification of Workplaces", the workplaces are evaluated according to three main criteria:

hygienic assessment of existing conditions and the nature of work; evaluation of the safety of workplaces;

accounting and assessment of the provision of workers with means of individual (collective) protection, training, etc.

Traumatic safety is estimated by the 1st, 2nd or 3rd class (without the degree of danger). Hygienic evaluation of existing conditions and the nature of labor is made on the basis of instrumental measurements of physical, chemical, biological and psychophysiological factors. The classification of these factors is given in GOST 12.0.003 SSBT.

The list of harmful production factors (with codes), given in the Regulations on the Procedure for the Certification of Workplaces, is used preliminary in determining certain factors specific to a particular workplace. After measurement, a class of working conditions at the workplace is determined. The most laborious work is the definition of a class of working conditions based on the indicators of the severity of the labor process and the intensity of labor. The main indicators of the severity of the labor process are:

dynamic physical load;

the mass of the load lifted and moved by hand;

stereotyped working movements;

static physical load;

working posture; slopes of the body; movement in space.

Each of these factors of the labor process is determined by the methodology described in the above manual R.2.2.755-99. A general assessment of the severity of the work process is made on the basis of all the above indicators. At the same time, a class is first established and entered into the protocol for each measured indicator, and the final assessment of the severity of the work is established according to the most sensitive indicator assigned to the highest class.

If there are two or more indicators of Classes 3.1 and 3.2, the overall score is set one degree higher. The main indicators of the intensity of the labor process include:

loads of intellectual nature (the degree of complexity of the work performed, the perception of information, the number and complexity of functions, responsibility for the final result); sensory loads (the duration of concentrated observation, the quality of perceived and transmitted signals, the number of objects of observation, etc.);

Monotony of loads (number of performed tricks and duration of their execution, time of active actions during the shift, etc.); mode of operation (number and duration of shifts, regulated breaks, etc.). Assessment of the intensity of the work process of a professional group of employees is based on the analysis of work activity and its structure, which are studied by timing observations in the dynamics of the whole working day for at least one week.

The analysis is based on taking into account the whole complex of production factors (stimuli, stimuli) that create the prerequisites for the emergence of adverse neuro-emotional states (overexertion). The analysis is based on taking into account the entire complex of production factors (stimuli, stimuli), creating prerequisites for the emergence of adverse neuro-emotional conditions (overvoltage). All factors (indicators) of the labor process have qualitative or quantitative expression and are grouped according to the types of loads: intellectual, sensory, emotional, monotonous, regime.

Regardless of their professional background (profession), all 22 indicators are taken into account. It is not allowed to selectively take into account any single indicators for the overall assessment of labor intensity. For each of the indicators separately, its own class of working conditions is determined. If any of the indicators is not represented by the nature or characteristics of the professional activity, the first class (optimal) is put on this indicator.

The final definition of the optimal, permissible and harmful classes of working conditions is based on the number of indicators that have one or another class. The overall assessment of working conditions by the degree of harmfulness and danger is established according to the highest class and degree of harmfulness. If three or more factors belong to class 3.1, then the overall assessment of working conditions corresponds to class 3.2. In the presence of two or more factors of classes 3.2, 3.3, 3.4, the working conditions are evaluated accordingly one degree higher. With the reduction of contact with harmful factors (time protection), working conditions can be assessed as less harmful, but not lower than class 3.1.

THEME 7.

BASICS OF SAFETY TECHNOLOGY IN THE SPHERE OF INFORMATION TECHNOLOGIES.

Information is the result and reflection in the human consciousness, the diversity of the inner and outer worlds (information about the objects, phenomena surrounding the person, actions of other people). Information security can be considered in the following values:

The condition (quality) of a certain object (information, data, resources of an automated system, automated system, information system of an enterprise, society, state, organization, etc.) can act as an object;

Activities aimed at ensuring the protected state of the object (in this meaning, the term "information protection" is more often used). Information security [3] is the process of ensuring confidentiality, integrity and accessibility of information.

Confidentiality Integrity Accessibility: Providing access to information and related assets of authorized users as and when required. Information security (English informationsecurity) - all aspects related to the definition, achievement and maintenance of confidentiality, integrity, accessibility, non-repudiation, accountability, authenticity and reliability of information or means of its processing.

Security of information (English information (security)) - the state of the protection of information (data), which ensures its (their) confidentiality, accessibility and integrity. The safety of information (data) is determined by the absence of unacceptable risk associated with leakage of information through technical channels, unauthorized and unintended impacts on data and (or) other resources of the automated information system used in the automated system.

Information security (in the application of information technologies) - the state of security of information (data), ensuring the security of information for processing which it is applied, and the information security of the automated information system in which it is implemented. The security of an automated information system is the state of the security of an automated system, in which confidentiality, accessibility, integrity, accountability and the authenticity of its resources are ensured.

Information security is the protection of information and supporting infrastructure against accidental or deliberate natural or artificial impacts that can cause unacceptable damage to subjects of information relations. Supporting infrastructure - systems of electricity, heat, water, gas, air conditioning, etc., as well as maintenance personnel. Unacceptable damage is damage that can not be neglected. The value of information is the most important criterion in making decisions about the protection of information.

The level of secrecy is an administrative or legislative measure that corresponds to the measure of the person's responsibility for the leakage or loss of secret competitive information, regulated by a special document, taking into account state-military strategic, commercial, service or private interests. Data protection statistics show that it is necessary to protect not only classified information, but also related to it, not secret. A systematic approach to the description of information security suggests the following components of information security:

Legislative, normative-legal and scientific basis. Structure and tasks of bodies (units) that ensure IT security. Organizational and technical and regime measures and methods (Information Security Policy). Software and hardware for information security. Below in this section, each of the components of information security will be discussed in detail. The purpose of implementing information security of an object is the construction of an Information Security System for this facility (SOIB). For the construction and effective operation of SOIB, it is necessary:

Identify information protection requirements specific to this protection object;

take into account the requirements of national and international legislation;

use the established practices (standards, methodologies) for building similar SOIBs;

identify the units responsible for the implementation and support of SOIB;

to distribute responsibility among the subdivisions of the oblast in the implementation of the requirements of SOIB;

on the basis of information security risk management, to determine the general provisions, technical and organizational requirements that constitute the Information Security Policy of the protection object;

implement the requirements of the Information Security Policy by implementing the appropriate software and technology and information protection tools;

Implement the Information Security Management System (ISMS);

using ISMS to organize regular monitoring of SOIB effectiveness and, if necessary, review and adjustment of SOIB and ISMS.

As can be seen from the last stage of the work, the SOIB implementation process is continuous and cyclical (after each revision) returns to the first stage, repeating successively all the others. So SOIB is adjusted to effectively perform its tasks of protecting information and meeting the new requirements of a constantly updated information system.

To describe the technology to protect the information of a particular information system, the so-called Information Security Policy or the Security Policy of the information system under consideration is usually built. Security policy (information in the organization) (English Organizationalsecuritypolicy) [6] - a set of documented rules, procedures, practices or guidelines in the field of information security, which guide the organization in its activities.

The security policy of information and telecommunication technologies - rules, guidelines, established practice that determine how to manage, protect and distribute assets within the organization and its information and telecommunication technologies, including critical information. In order to build the Information Security Policy, it is recommended to consider separately the following areas of information system protection :

Protection of information system objects;

Protection of processes, procedures and programs of information processing; Protection of communication channels (acoustic, infrared, wired, radio channels, etc.), including protection of information in local networks;

Suppression of secondary electromagnetic emissions;

Management of the protection system.

At the same time, for each of the above directions, the Information Security Policy should describe the following stages in the creation of information security tools:

Identification of information and technical resources to be protected;

Identify the full range of potential threats and channels of information leakage;

Conducting an assessment of the vulnerability and risks of information in the presence of a variety of threats and channels of leakage; Defining the requirements for the protection system;

Realization of a choice of means of protection of the information and their characteristics;

Implementation and organization of the use of selected measures, methods and means of protection;

Implementation of integrity control and management of the protection system.

The information security policy is formalized in the form of documented requirements for the information system. Documents are usually divided into levels of description (detail) of the protection process. Top-level documents Information security policies reflect the organization's position in the field of information security, its desire to comply with state,

international requirements and standards in this field. Such documents can be called "IB concept", "IB management rules", "IB policy", "IB technical standard", etc. The scope of distribution of top-level documents is usually not limited, but these documents can be issued in two editions - for external and internal use. According to GOST R ISO / IEC 17799-2005, the upper level of the Information Security Policy should contain the following documents: "The concept of IS security", "Rules for the permissible use of information system resources", "Business continuity plan". The average level refers to documents relating to certain aspects of information security. These are the requirements for the creation and operation of information security tools, the organization of information and business processes of the organization in a specific area of information protection. For example: Data security, Security of communications, Use of cryptographic protection facilities, Content filtering, etc. Such documents are usually issued in the form of internal technical and organizational policies (standards) of the organization. All medium-level documents of the information security policy are confidential.

The information security policy of the lower level includes work regulations, administration manuals, instructions for operating individual information security services.

THEME 8.
SANITARY AND ERGONOMIC REQUIREMENTS TO THE WORKPLACE.

To create comfortable and safe working conditions, a comprehensive study of the human-machine-production system is necessary, which are closely interrelated and affect safety, productivity and human health. Ergonomics - a science that comprehensively studies a person in the specific conditions of his activity in modern production. The object of ergonomics is man-machine.

In order for the link man-machine to function effectively and not to damage human health, it is necessary to ensure the compatibility of the characteristics of the machine and the person. The components of compatibility are man-machine:

1. Anthropometric compatibility involves taking into account the dimensions of the human body, the

possibility of reviewing the external space, position in the process of labor activity.

2. Sensomotor compatibility is based on the speed of human motor operations. 3.Energetic compatibility implies the account of the physical forces of man.

4. Psychophysiological compatibility takes into account the person's reaction to light and sound.

The workplace of a person should have the optimal parameters for performing work activities:

1. Convenient placement of the employee, taking into account the movement in the work process.

2. Performing all work operations in a convenient position.

3. The location of the control panel within the boundaries of the worker's movement space.

4. Optimal overview of visual information.

5.Ability to change working posture

6.Free access to the repair and adjustment of equipment.

Ergonomic requirements:

1. The implementation of rational modes of work and leisure

2. Reducing emotional stress and physical exertion

3.Professional selection of an employee.

Artificial lighting in the premises for the operation of a personal computer must be carried out by a system of general uniform illumination. In production and administrative-public premises, in cases of primary work with documents, combined lighting systems should be used (in addition to general lighting, local lighting fixtures are also installed to illuminate the location of documents). As sources of light under artificial illumination, predominantly fluorescent lamps of the LB type and compact fluorescent lamps (CFL) should be used. At the device of the reflected illumination in industrial and administratively public premises the use of metal halide lamps is allowed. In the lamps of local illumination incandescent lamps, including halogen ones, are used.

To ensure the normalized values of illumination in the premises for the use of a personal computer, it is necessary to clean the windows of window frames and lamps at least twice a year and to replace the burned lamps in a timely manner. The windows in the premises where the computers are in operation should be oriented mainly to the north and north-east. Window openings should be equipped with adjustable devices such as blinds, curtains, external visors, etc. The area of one workstation for users of a PC with VDT on the basis of a cathode-ray tube (CRT) should be at least 6 m2, in rooms of cultural and entertainment establishments and with VDT on the basis of flat discrete screens (liquid crystal, plasma) - 4.5 m2.

When using a PC with a CRT based on a CRT (without ancillary devices - printer, scanner, etc.) that meet the requirements of the international computer security standards, with a duration of less than four hours per day, a minimum area of 4.5 m2 per user workstation is allowed.

Premises where workplaces are located with a PC must be equipped with a protective earth (zanuneniem). Do not place workplaces with a PC near power cables and bushings, high-voltage transformers, technological equipment that interferes with the operation of the PC.

In production facilities in which work with PC is auxiliary, the temperature, relative humidity and speed of air movement at workplaces must correspond to the current sanitary norms of the microclimate of production premises. In the industrial premises where the work with the PC is the main (dispatching, operator, settlement, cabs and control posts, computer rooms, etc.) and is associated with a neuro-emotional tension, optimal microclimate parameters should be provided for the category of works Ia and I b in accordance with the current sanitary and epidemiological standards of the microclimate of industrial premises.

At other workplaces, the microclimate parameters should be maintained at an acceptable level that meets the requirements of the above standards. In rooms equipped with PC, daily wet cleaning and systematic ventilation after every hour of work on the PC must be carried out. For finishing the interior of the premises, materials of pastel tones with matte texture should be used, the floor covering should be made of smooth, non-slip materials with antistatic properties. All materials used for finishing the premises must meet hygienic requirements and be allowed to be applied by the bodies and institutions of sanitary and epidemiological supervision.

Premises with VDT and PC must be equipped with heating systems. The premises must have a first aid kit and fire extinguishing means. Requirements for the organization of workplaces for users of PC. When placing workplaces with a PC, the distance between the work tables with video monitors (in the direction of the rear of the surface of one video monitor and the screen of another video monitor) should be at least 2.0 m, and the distance between the side surfaces of the video monitors is not less than 1.2 m. The work tables should be placed in such a way that the video display terminals are oriented side by side to the light apertures and the natural light falls mainly on the left.

Workplaces with a PC in the performance of creative work, which requires considerable mental strain or high concentration of attention, it is recommended to isolate each other by partitions with a height of 1.5-2.0 m. The screen of the video monitor should be from the user's eyes at a distance of 600-700 mm, but not closer than 500 mm, taking into account the sizes of alphanumeric characters and symbols. The keyboard should be placed on the surface of the table at a distance of 100-300 mm from the edge facing the user, or on a special, height-adjustable work surface, separated from the main countertop.

For the convenience of reading documents, you should use mobile stands (music stands), which should be placed in the same plane and at the same height as the screen.

The design of the working chair (chair) should ensure the maintenance of a rational working posture in the work of a PC, allow you to change the posture in order to reduce the static tension of the muscles of the cervico-brachial region and back to prevent the development of fatigue. The type of chair (chair) should be chosen taking into account the growth of the user, the nature and duration of work with the PC.

The working chair (chair) must be liftable, adjustable in height and angle of inclination of the seat and backrest, and also the distance of the backrest from the front edge of the seat. In this case, the adjustment of each parameter must be independent, easy to implement and have a reliable fixation. The surfaces of the seat, backrest and other chair elements (armchairs) should be semi-soft, with a non-slip, slightly electrifying and breathable coating, ensuring easy cleaning of the contaminants.

The workplace of the user of the PC should be equipped with a footrest having a width of at least 300 mm, a depth of at least 400 mm, height adjustment within the range of up to 150 mm and a slope of the support surface of the support up to 20 °. The surface of the stand must be fluted and have a bead 10 mm high along the leading edge.

A personal computer is the source of alternating electric and magnetic fields. It is generally believed that the main source of EMF, which determines the electromagnetic environment are the components of the PC, primarily a video monitor. As shown by numerous studies, in addition to EMF display sources (batteries, high-voltage elements, frame and line scanning units), there is another source of alternating electric field in the displays on cathode-ray tubes - the display screen itself. When the character of the image changes on the display screen, the levels of their electromagnetic fields can vary, including in the direction of increasing in relation to the values recorded during the test tests. Until now, monitors are tested only with a text picture, and in this mode of operation, the level of EMF from the included computer remains normal. In particular, a sharp increase in the field strength occurs while working with graphic information, especially when the image is sharper on the monitor screen. As practice shows, in a number of cases the EMF intensity is created by external sources, i.e., elements of the power supply system of the building, transformers, overhead power lines, etc. Therefore, when installing the PC in the workplace, it must be properly connected to the power supply and reliably grounded. During operation, the protective filter must be firmly mounted on the display screen and reliably grounded. Daily it should be cleaned of dust, as well as the display screen. To protect workers working at adjacent workplaces, it is recommended to install special protective screens between the work tables that have a coating that absorbs low-frequency electromagnetic radiation.

Organization of safety service. The organization of work at the enterprise for the creation of healthy and safe working conditions for workers, prevention of accidents and occupational diseases is entrusted to the labor protection service.

It is an independent structural subdivision of the enterprise and is subordinate to its immediate supervisor or chief engineer, carries out its work jointly with other departments of the enterprise and in cooperation with the trade union committee, technical labor inspection and local state supervision bodies according to the plan approved by the head or chief engineer of the enterprise. The Labor Protection Service, in accordance with the main tasks assigned to it, performs the following functions:

- Analyzes the state and causes of occupational injuries and occupational diseases, develops measures in conjunction with the relevant services to prevent accidents at work and occupational diseases, and also controls their implementation;
- organizes the work on the certification of the sanitation and technical condition at the workplaces by the departments of the enterprise;

• organizes together with the relevant services of the company the development and implementation of a comprehensive plan to improve working conditions, labor protection and sanitation, and also participates in the development of labor agreements;

• prepares and submits to the company's management proposals for the development and implementation of more advanced structures, safety devices and other means of protection against hazardous production factors;

• Participates in the work on the implementation of labor safety standards and scientific developments in labor protection;

• conducts, jointly with the relevant services of the enterprise and with the participation of the trade-union asset, inspections (or participates in inspections) of the technical condition of buildings, structures, equipment, the efficiency of ventilation systems, the condition of sanitary facilities, sanitary facilities;

• controls the correctness of compilation and timeliness of submission of applications for the purchase of overalls, special equipment and other personal protective equipment, as well as equipment and materials for the implementation of labor protection measures;

• Provides assistance to the company's subdivisions in the organization of monitoring the state of the environment;

• participates in the work of commissions for the commissioning of new and after the reconstruction of production facilities, equipment and machinery, verifying compliance with the requirements for ensuring healthy working conditions;

• Provides induction instruction and assists in the organization of training of employees on labor protection issues in accordance with GOST 12.0.004-93 and the current regulatory documents;

• participates in the work of the attestation commission and the commission for checking

knowledge of the rules and norms on labor protection by the specialists, and safety instructions.
In accordance with the Labor Code of the Republic of Uzbekistan, the organization of labor safety in the units is entrusted to their managers, who provide instruction on labor protection in the workplace.

The overall responsibility for the organization of work on labor protection is the head of the enterprise, and in his absence - the chief engineer. In the committees of the trade union of enterprises there are commissions on labor protection, and in each subgroup a public inspector for labor protection is elected. The labor safety committees organize and conduct public reviews on labor protection and production culture, take part in the preparation of draft agreements on labor protection between the administration and the trade union organization, monitor the implementation of these agreements and labor legislation by the administration.

Public inspectors of the units carry out control over labor protection directly at workplaces. Senior public inspectors take part in the investigation and documenting of accidents at work.

Safety in working with optical devices. Let's consider several aspects of safety techniques when working with optical fiber: the classification of radiation sources according to the degree of their danger to vision, the methods of working with optical fibers and the use of chemicals.

Sources of radiation and precautions.

As a result of the development of the industry for many years, we have several types of radiation sources of different power, operating at quite defined wavelengths (see table). In fiber optic systems, three types are used: light-emitting diodes, conventional lasers and surface-radiation lasers with a vertical resonator (Vertical-CavitySurface-EmittingLaser - VCSEL). There are several versions of these three types of devices: lasers with a Fabry-Perot resonator and distributed feedback, as well as surface and end-face LEDs. In addition, amplifiers are widely used to amplify optical signals, including semiconductor (SemiconductorOpticalAmplifier - SOA) and more common amplifiers based on erbium-enriched fibers (Erbium-DopedFiberAmplifier - EDFA).

Note. Some lasers, including the VCSEL type, are listed with two classes at once, since they exist in variants with different power and for different applications. In case of doubt, choose a more powerful class 3 laser.
In North America, the main standard, issued by the American Laser Institute (LaserInstituteofAmerica) in 1988 and defining security measures for working with optical cable systems, is ANSI Z136.2. (see "Classification of sources of laser radiation according to their degree of danger to vision").
Detection of radiation.

Among the devices used to detect radiation, the most common are the optical power meters. They contain photodetectors, which measure the power of radiation of different wavelengths. In addition, other devices are used - photosensor cards that respond to infrared radiation incident on them with the appropriate electronic activation, and infrared vision devices that convert infrared radiation with wavelengths of 800 and 1300 nm into visible light. With the help of the latter, the power characteristics of the radiation sources are usually determined.

Specialists dealing with optical data transmission technology must be guided by the rule that any fiber can be active. Therefore, never look into the transmitter outlet or the end of the connector. To inspect the elements of optical cable systems, the most common instrument is a microscope. It is clear that it allows you to explore the surface of the fiber end but can not detect the infrared radiation emanating from it.

To control the quality of surface treatment of fibers, microscopes with an increase of 200-400 times are suitable. Usually, to protect the eyes, a laser filter is built in them, which attenuates the radiation level by 2-35 dB, depending on the wavelength. Microscopes with filters are slightly more expensive than conventional ones, but they are safer. In your work, always use just such microscopes and, before ordering them, study the specification of each of them. The cheaper microscopes, with an increase of 30-100 times, which many sets complete for the installation of optical cable systems, often do not have filters at all.

In any case, working with such a microscope, the user should always wear glasses that protect the eyes from laser radiation.

Fiber processing. In most optical cable systems, a coated glass fiber is used. The latter provides the necessary strength, simplifies handling of the fiber and allows the manufacturer to label the fibers in different colors for the purpose of visual identification. During the installation of connectors or splicing of cables, the sheath is removed, which allows the fibers to be combined with the required accuracy.

At the time of the removal of the shell, a number of questions arise concerning the proper handling of tools and chemicals, the processing of fiber and the utilization of its fragments. As soon as the outer shell is removed, the fiber becomes unprotected and easily breaks. The probability of falling fragments of fiber under the skin at this moment is greatest. Therefore it is desirable to equip the workplace so that it is safe. Suitable for this rugs and tables are produced by many manufacturers. The surface of the table must have a coating that contrasts in color with the fiber to be processed, and this is just one of the conditions for a more convenient and safe operation. For laboratory and industrial premises, a black surface that does not reflect light and is resistant to chemical agents is suitable and easy to clean; The design of the table should be such that fragments of fiber do not accumulate in its seams and along the edges.

For the field conditions, black mats with a matte surface are recommended; their main quality is low weight and transportability (they are easily rolled up and stored in a box with tools). Alternatives can be working tables of three types. A small light table is best for telecommunication rooms. A safe working environment requires a non-reflecting work surface and a fiber cutter container. For those who are engaged in splicing cables, longer tables with a height adjustment are best suited. It is also desirable to have good lighting, magnifying glasses and devices for fixing cables that protect them from damage.

Well illuminated workplace lamp with a "goose neck", which are very good in both laboratory and field conditions.

Protective glasses. When working with Class 3 lasers, personnel should wear protective goggles with appropriate filters. Specialists dealing with components based on VCSEL type lasers should wear safety glasses designed for a wavelength of 850 nm. In addition, they should be equipped with filters with optical density (opticaldensity - O.D.), corresponding to a specific application task. For example, at O.D., equal to unity, the attenuation of the transmitted optical radiation is 10 dB; with O.D. , equal to 2, - 100 dB, etc. Knowing the output optical power of the radiation source, it is possible to determine the required value of O.D., which reduces the power of the transmitted radiation to a safe level. When handling fibers, especially when mounting connectors and splicing cables, conventional safety goggles are perfectly suitable.

In normal operation, they prevent the penetration of fiber fragments into the eyes. However, suppose you suddenly wanted to rub your eyes. If, at the same time, pieces of fiber adhere to the hands, such a desire, which is innocuous at first glance, can negate the protective function of protective glasses: the fragments of the fiber are small and transparent, they can easily stick to the skin, remaining invisible. For the same reason, it is recommended to wash hands more often, and this will be another means of protecting the eyes. Since the work in glasses is necessary and will have to be carried out in them for a long time both in laboratory and in the field, special attention should be paid to their design and convenience.

Utilization of fragments.

Fiber fragments must be properly disposed of. To do this, waste should be collected in special containers such as small, closed bottles. Fragments are usually thrown into the trash can, on which a plastic bag should be put. On the bucket also need to make a clear inscription: "Contains glass shards." Empty the bucket, do not squeeze the package, place it in another bag, and tie it.

The disposal of fiber fragments is the responsibility of the cable contractor and must be included in the work order, in the bill for payment or in a contract. Fibers should never be thrown under the raised floor, where they may be injured in the future by unsuspecting workers. Even with all precautions, anyone who deals with fiber is not immune from pinching a finger. Most often this happens during the installation of connectors or splices of cables, when the fiber is removed from the shell.

What should I do in this case? Remove the fragments from under the skin "you need tweezers with Teflon coating. It has a more resilient surface than a conventional steel tweezers. The latter can break a splinter, leaving part of it under the skin.

Chemicals in the workplace. As in many other industries, various chemical preparations are used in the work with fiber optics. Some cables use water repellent gels; in many connectors, the fibers are fixed with epoxy glue with ultraviolet, anaerobic or thermal curing;

When selling all of these materials, a "Material Safety Precautions Handbook" (MaterialSafetyDataSheet - MSDS) must be attached. As part of the "right to know" law, MSDS requirements stem from the HazardCommunicationStandard standard developed by the Occupational Safety and Health Administration under the US Department of Labor, issued in 1985. MSDS includes detailed information on the manufacturer of the drug; on dangerous substances contained in it; on physical properties, flammability and explosiveness;

health hazards; data on its ability to react with other substances; on the procedures for unpacking and use, as well as on all special protective measures and precautions that must be followed when using this drug. When ordering chemical preparations or materials containing chemicals, always require the MSDS instruction. In addition, these instructions should be at hand and when working in the field.

In places of work with fiber should be prohibited from eating and drinking. It is best to do this in specially designated places and do not forget to always wash your hands after working with fiber and chemicals. Despite the fact that there are a great many safety rules in the workplace, they are effective only when they are strictly observed. To create a security problem, one person is enough, and only one person is able to prevent it. Laser radiation is electromagnetic radiation with a wavelength of 0.2 ... 1000 μm: from 0.2 to 0.4 μm - the ultraviolet region; more than 0,4 to 0,75 microns - visible area; over 0.75 to 1 μm - near infrared; over 1.4 μm is the far infrared region.

The sources of laser radiation are optical quantum generators, lasers, which have found wide application in science, technology, technology (communication, location, measuring technology, holography, isotope separation, thermonuclear fusion, welding, metal cutting, etc.).

Laser radiation is characterized by an exceptionally high level of energy concentration: the energy density is 1010 ... 1012 J / cm3; the power density is 1020. 1022 W / cm3. By form of radiation it is divided into direct (enclosed in a limited solid angle); scattered (scattered from a substance in the medium through which the laser beam passes); mirror-reflected (reflected from the surface at an angle equal to the angle of incidence of the beam);

on the diffusely reflected (reflected from the surface in all possible directions). In the process of operating laser installations, service personnel may be exposed to a large group of physical and chemical factors of hazardous and harmful effects. The following factors are the most characteristic when servicing a laser installation: a) laser radiation (direct, scattered or reflected); b) ultraviolet radiation, the source of which are pulsed pumping lamps or quartz gas-discharge tubes; c) brightness of light emitted by impulsive lamps or target material under the influence of laser radiation;

d) electromagnetic radiation of the HF and microwave range; e) infrared radiation; g) the temperature of the equipment surfaces; h) electric current of control circuits and power supply; i) noise and vibration; k) destruction of laser pumping systems as a result of the explosion; l) dustiness and gas contamination of the air, resulting from the effect of laser radiation on the target and radiolysis of air (ozone, nitrogen oxides and other gases are released). Simultaneous impact of these factors and the degree of their manifestation depend on the design, the characteristics of the installation and the features of the technological operations performed with its help. Depending on the potential danger of servicing laser installations, they are divided into four classes.

The higher the installation class, the higher the risk of radiation exposure to personnel and the greater the number of hazards and harmful effects manifests simultaneously. If for the first class of danger laser installation is usually characterized by only the danger of an electric field, then for the 2nd class is also a danger of direct and specular reflected radiation; for the third class - also the danger of diffuse reflection, ultraviolet and infrared radiation, brightness of light, high temperature, noise, vibration, dust and gas contamination of the working area.

The laser installation of the 4th hazard class is characterized by the full presence of the potential hazards listed above. As the main criteria for the standardization of laser radiation, the degree of change that occurs under their influence in the organs of vision and human skin is chosen. Safety when working with lasers is estimated by the probability of achieving a particular pathological effect, determined by:

$P_{bez} = 1 - P_{ham}$ (3.47) where $P_{без}$ - probability of safety of work with the laser in concrete conditions; RPat - the actual pathological effect, measured when exposed to laser radiation.

At present, it has been proved that when laser radiation is affected (especially with a single laser beam), there is a unique relationship between the quantitative index of the intensity of the field effect and the effect produced by it.

When working in electrical installations use:

• means of protection against electric shock (electric protective equipment);

• Collective and individual means of protection against electric fields of increased tension (in electrical installations with a voltage of 330 kV and above);

• personal protective equipment (PPE): heads (protective helmets); eyes and face (goggles and shields); respiratory organs (gas masks and respirators); hands (mittens); from falling from height (safety belts and safety ropes); special protective clothing (kits for protection against electric arc).

Electro-protective means are designed to protect people in the maintenance of electrical installations. In accordance with the Instruction for the application and testing of protective equipment used in electrical installations, they are divided into:

- Isolating (basic and additional);
- enclosing;
- auxiliary.

Isolating electro-protective means (Figure 8.1) serve to isolate a person from live parts and earth. They are divided into basic and additional.

Isolation of the main insulating means withstands the full operating voltage of electrical installations, and they are allowed to touch current-carrying live parts. Additional means can not independently ensure the safety of maintenance personnel and they are used in conjunction with basic means to enhance protective action.

a, b - insulating rods; c - insulating pliers; d - dielectric gloves; d - dielectric bots; e - dielectric galoshes; ж - rubber mats and paths; 3 - insulating stand; and - tools with insulating handles; k - current clamp; l - voltage indicator

The main insulating electro-protective means for electrical installations with voltages above 1000 V are:

• insulating rods of all kinds;

• isolating pliers;

• voltage indicators;

• Devices and devices for ensuring the safety of work in measurements and tests in electrical installations (voltage indicators for checking the coincidence of phases, electrical clamps, puncture devices, etc.);

• special protective equipment, devices and insulating devices for work under voltage in electrical installations with a voltage of 110 kV and higher (except for the rods for transfer and equalization of the potential).

To additional insulating electro-protective means for electrical installations with voltages above 1000 V are:

- Dielectric gloves and bots;
- Dielectric carpets and insulating stands;
- insulating hoods and covers;
- rods for carrying and equalizing the potential;
- ladders ladders, ladders insulating fiberglass.

THEME 9.
INSTRUCTIONS AND TRAINING OF EMPLOYEES TO SAFE WORK METHODS

Training in safe work methods, occupational safety requirements at each workplace, for each type of work, including with increased danger, is carried out directly at the enterprise, is one of the important tasks of the OSH and is organized by the management of the enterprise. The system of safety training is presented below. It includes three main components: the actual training in safe methods and methods of work, organizational and technical and scientific-methodological support. It is carried out in accordance with GOST 12.0.004-79, which determines the order and types of training of workers and the IGR on labor protection issues. Training of workers includes production briefings and further training. Employed, as well as working in the enterprise, whose duties include maintenance, testing, adjustment and repair of equipment, use of tools, storage of raw materials and materials, must pass an introductory, primary, repeated, unscheduled, current safety briefing.

Safety training at the enterprise begins with an introductory briefing, conducted by a labor safety engineer (safety engineer) for 2-3 hours with those who came to work individually or with a group of workers according to a program approved by the chief engineer. The briefing includes the main provisions of the legislation on labor protection, the rules of internal labor regulations and behavior on the territory of the enterprise, the requirements for the organization and maintenance of the workplace,

basic rules of safety and industrial sanitation, as well as the use of personal protective equipment. Instruction is registered in the introductory briefing book, which is kept for 35 years. Every instruction that has been given is given a manual on labor protection, developed taking into account the specific conditions of production and the specifics of the work. All other briefings are conducted by the direct supervisor of the work. Prior to admission to independent work with each newly adopted, transferred, seconded, with a former student to practice and other persons doing a new job, a primary briefing is conducted directly at the workplace.

It is carried out by the master individually with each volume of instructions for certain types of work or occupations of the given production, which is registered in a personal briefing card. The master acquaints the employee with general information about the technological process and equipment in this area of production, the equipment on which he is to work, safety devices and fences, alarm systems, with potentially dangerous and harmful production factors of a particular workplace, equipment being serviced and the tool used, and also explains the actions that must be taken in case of hazardous situations to prevent possible adverse consequences. For the practical assimilation of safe methods and methods of work in the workplace, a new worker is attached to a skilled worker for several shifts and is under his constant supervision, after which an admission to independent work is issued. A repeated (regular, planned) briefing was conducted by the master at the workplace with the frequency established for the given production and type of work.

This periodicity does not exceed six months for normal work and three months for work with increased danger. Re-training is recorded in the personal briefing card.

Unscheduled briefings are conducted by the master individually or with a group of workers of the same profession. They are carried out by changing the rules of labor protection, technological process, violations of safety requirements by employees, which can lead to injury, accident, explosion or fire, accidents in production,

after a long absence of the employee (more than 30 days for work, which are subject to increased security requirements, and more than 60 days for other jobs). The current briefing is conducted with the employees before the production of work, for which the outfit is issued. In the order-admission is recorded instruction. In addition to briefing, knowledge in the field of occupational safety is improved in the courses of advanced training (targeted, production and technical) organized by the departments of technical training,

as well as on special courses on work safety and in schools of excellence. Typical training programs are approved by ministries (departments) in coordination with the Central Committee of Trade Unions, and, if necessary, with state supervision bodies. On their basis, programs are developed to improve the skills of workers in production and technical courses, training courses for second and related professions, etc. They necessarily contain sections on occupational safety, the volume of which is not less than 0% of the total training course. Workers of food production, who are entrusted with the independent performance of responsible and dangerous work, undergo special course training in occupational safety, organized in the relevant specialties directly at the enterprise. The list of professions and jobs, to which additional (increased) requirements for occupational safety are made, is approved by the management of the enterprise. At bakery, confectionery, pasta, sugar enterprises and fermentation plants, course training on approved programs must necessarily pass workers before admission to the maintenance of the following equipment or the performance of the following: steam and hot water boilers, industrial furnaces and other heat installations operating under the pressure of vessels and apparatus; compressors, refrigeration units, gas equipment; electrotechnical installations, hoists, hoisting mechanisms, tractor shovels, shoulder spreaders, shroud-hacking machines, forklift trucks, autocars, electric cars, tractors and other intra-plant and internal mechanized transport; gas-electric welding equipment;

apparatus for diffusion and evaporation, melting of massecuite, centrifuges, acid and alkaline plants, bulk storage plants, washing food raw materials; rigging, assembly, repair, loading, unloading and other works.

After passing the course training, workers take exams, are certified, they are handed a certificate with a mark of its validity and they are allowed to perform the relevant work. These categories of workers are annually tested in safety knowledge, which is noted in the certificate.

Engineering enterprises undergo an introductory briefing, and every three years - a re-examination of knowledge of safety regulations. With a frequency of at least 1 time in six years, engineers increase their knowledge in special courses on labor protection in enterprises, research institutes, institutes for advanced training or at faculties and advanced training courses at higher educational institutions.

Great importance for improving the quality and effectiveness of training in occupational safety at enterprises has its organizational, technical and scientific and methodological support. It includes the selection and training of qualified personnel for training, the creation of an educational and production base corresponding to modern requirements at the enterprise, providing it with quality visual and educational aids, technical training aids, training programs, methodological recommendations and labor safety standards.

An important role in improving the training of workers in safe methods and methods of work belongs to the labor protection offices, which are organized at the enterprise in accordance with the "Model Provision on the Occupational Safety Cabinet". For the office should be allocated a special room, the area of which depends on the number of employees in the enterprise. In the offices, introductory and other briefings, thematic classes and seminars on labor protection for engineers and workers, lectures, conversations, watch films and film screenings on labor protection, provide information on new books, advice for shop workers and

departments for the organization of exhibitions and places for labor protection, information is exchanged on labor protection issues (through the technical information departments of the enterprise), taking into account the achievements of other related enterprises with a view to popularizing and disseminating their best practices. Labor safety cabinets are equipped with visual aids (educational posters, diagrams, mock-ups, natural exhibits, filmstrips and movies), technical means of propaganda and training (film projectors, slide projectors, tape recorders, simulators),

methodical recommendations and reference materials for seminars, briefings and thematic sessions. In the offices for self-study, control and self-control of knowledge, along with the usual, a programmed method is used, which involves the use of training and control machines. With a programmed machine method, the learner's knowledge is evaluated using the machine based on responses to tickets prepared under different sections of labor protection. The most perfect form of learning and control by a programmed method is the use of a computer, in memory of which questions and answers are coded. The computer is especially useful for self-training, since it allows the instructor to work with it in the interactive mode.

Widely used is also the programmed method of machine-free control of knowledge on labor protection, the essence of which is as follows. The examiner selects the ticket and receives a clean control card. The ticket lists five questions and two to five answers for each of them, with only one correct answer.

The examiner should in each horizontal line, the number of which corresponds to the number of the question, shade the square whose number, in his opinion, coincides with the correct answer.

THEME 10.
FIRE SAFETY

Plan:

1. Types, properties of fire, combustion mechanism.

2. The system of enterprises for fire protection.

3. Analysis of fire hazards in the production process.

4. General requirements and rules of fire safety.

5. Means, methods of control and fire fighting.

6. Fire precursors and communication system.

7. Law on Fire Safety.

Basic terms: *combustion process, explosion and fire, fire prevention measures, extinguishing tools, fire extinguishing equipment, fire precursors, communication system, fire extinguisher and sprinkler devices, beam and daisy fire precursors, fire phases,* *combustible material, temperature, extinguishing agents, consequences of fire, foam, liquid extinguisher, hard muffler, fire causative agent, fire resistance, evacuation, obstacles to fire, fire shield.*

Combustion is a chemical reaction of oxidation, accompanied by the release of a large amount of heat and glow. Oxygen is most often the oxidant, and sometimes other chemical elements: chlorine, fluorine, etc.

For example, copper can burn in sulfur vapors, magnesium in carbon dioxide. For the occurrence of the combustion process, it is necessary to have a combustible substance, an oxidizing agent and an ignition source. Fuel is a substance (material, mixture, construction) that is capable of burning itself after removing the ignition source. The source of ignition means a hot or hot body, as well as an electric discharge, which have a supply of energy and a temperature sufficient for the combustion of other substances (flames, sparks, incandescent objects, frictional heat, etc.).

Burning is complete and incomplete. Complete combustion takes place with a sufficient amount of oxygen (not less than 14%), as a result of which substances that are incapable of prolonged oxidation (carbon dioxide, water, nitrogen, etc.) are formed. With insufficient oxygen content (less than 10%), incomplete flameless combustion (smoldering) takes place, accompanied by the formation of toxic and combustible products (alcohols, ketones, carbon monoxide, etc.).

Fire - this uncontrolled burning outside a special focus, causing material damage. The fire should be distinguished from burning, which is controlled combustion inside or outside a special hearth. The fire hazard of the facility is the possibility of a fire and the consequences resulting from such an event.

Types, properties and combustion mechanism

The fire safety of an object is such a state in which the possibility of the occurrence and development of a fire, the exposure of people to dangerous and harmful fire factors, and the protection of material values are prevented with a regulated probability.

To dangerous and harmful factors of the fire include open fire, elevated temperature of the environment and objects, toxic combustion products, smoke, reduced oxygen concentration, falling parts of building structures; during the explosion - a shock wave, flying parts and harmful substances. Combustion can be diffusive and kinetic. If oxygen penetrates into the combustion zone due to diffusion, then it is called diffusion. The height of the flame is inversely proportional to the diffusion coefficient, which in turn is proportional to the temperature in the range of 0.5 to 1. Kinetic combustion occurs when the combustible gas is premixed with air.

However, in the flame simultaneously processes of diffusion combustion and combustion of premixed components of the combustible mixture can occur. There are also homogeneous combustion of substances of the same aggregate state (most often gaseous) and heterogeneous combustion of combustible substances in various aggregate states. The last type of combustion is simultaneously diffusive. Different combustible substances can burn faster or slower. The burning rate is characterized by the amount of combustible matter burning per unit time from a unit area. Depending on the speed of the process, the actual burning, explosion and detonation are distinguished.

An explosion is a rapid transformation of a substance (explosive combustion), accompanied by the formation of a large number of compressed gases, under the pressure of which destruction can occur. Combustible gaseous products of an explosion, in contact with air, often ignite, which usually leads to a fire, exacerbating the negative consequences of the explosion. Detonation combustion occurs in an explosive atmosphere when a sufficiently strong shock wave passes through it. In shock compression, the gas temperature can rise to the autoignition temperature.

There is a chemical reaction. Part of the released heat is expended on the energy development and strengthening of the shock wave, so it moves along the combustible mixture unabated. Such a complex, which is a shock wave and a zone of chemical reaction, is called a detonation wave, and the phenomenon itself is a detonation. Detonation combustion causes severe damage and therefore presents a great danger in the formation of combustible gas systems. However, it can occur only at a certain minimum required initial pressure and certain concentrations of a combustible substance in air or oxygen.

It is necessary to distinguish between the terms "spontaneous combustion" and "self-ignition". Self-ignition is a phenomenon of a sharp increase in the rate of exothermic reactions, leading to the burning of a substance, material or mixture in the absence of an ignition source. It can be thermal, chemical and microbiological. Self-ignition represents spontaneous combustion, accompanied by the appearance of a flame.

The temperature of autoignition of most combustible liquids is in the range 250 ... 700 ° C (exceptions: carbon disulfide 112 ... 150 ° C, sulfur ether 175 ... 205 ° C), and solid combustible substances - 150 ... 700 ° C, although, for example, celluloid is able to self-ignite even at a temperature of 141 ° C.

Stages (stages) of fire development, their definition:

Phase I (10 min) - the initial stage, which includes the transition of fire into a fire (1-3 min) and the growth of the combustion zone (5-6 min). During the first phase, a predominantly linear spread of fire along a combustible substance or material occurs. Combustion is accompanied by abundant smoke evolution, which makes it difficult to determine the place of the fire. The average volume temperature rises in the room to 200 ° C (the rate of increase in the average volume temperature in the room is 15 ° C in 1 min). The influx of air into the room first increases, and then slowly decreases.

Therefore, it is very important at this time to ensure the insulation of this room from outside air is not recommended to open or open windows and doors in a burning room. In some cases, with sufficient provision of air tightness of the room, self-extinguishing of the fire occurs, and call fire departments at the first signs of a fire (smoke, flame). If the fire is visible, it is necessary, if possible, to take measures to extinguish the fire with primary firefighting equipment before the arrival of fire departments.

The duration of phase I is 2-30% of the total duration of the fire. II phase (30-40 min) - stage of volumetric development of a fire. The turbulent process, the temperature inside the room rises to 250-300 oC, the volumetric development of the fire begins, when the flame fills the entire volume of the room, and the process of spreading the flame is no longer superficial, but remotely, through air gaps. The destruction of the glazing in 15-20 minutes from the start of the fire. Due to the destruction of the glazing, the influx of fresh air sharply increases the development of the fire. The rate of increase in the average volume temperature is up to 50 ° C in 1 min.

The temperature inside the room rises from 500-600 to 800-900 ° C. The maximum burn-up rate is 10-12 minutes. The fire is stabilized 20-25 minutes from the start of the fire and lasts 20-30 minutes. Phase III - fading stage of a fire. Afterburning in the form of slow decay, after which, after a while (sometimes very long), the fire burns out and stops. The development of a fire is a change in its parameters in time and space from the onset of the occurrence to the complete elimination of combustion.

In the development of the fire, three periods (interval) are distinguished: the free development of tcv, the localization of the tłok and the elimination of the fire. Free combustion - the development of a fire occurs unhindered from the onset of its occurrence to the adoption of initial measures for extinguishing. Localization - stage (stage) of fire extinguishing, where the threat to people and (or) animals is not eliminated or eliminated, the spread of the fire is stopped and conditions for its liquidation by available forces and facilities are created. Liquidation is the stage (stage) of fire extinguishing, on which burning is stopped and conditions for its spontaneous emergence are eliminated.

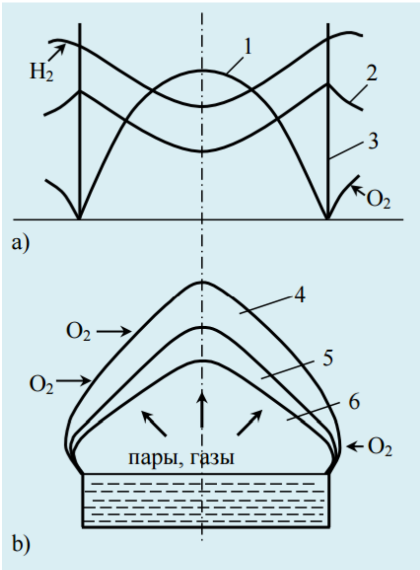


Fig. 10.1. The combustion process. a) distribution of combustible gas: 1-combustible gas, 2-combustible product, 3-edge fire; b) a piece of fire: 4.5, 6-boundaries of diffusion combustion.

Classification of premises and buildings for fire and explosion hazard

The fire prevention measures envisaged in the design of each concrete building (structure, premises) must take into account the degree of its fire or explosion hazard, which depends on the production located in this building (construction, room). Depending on the nature of the technological process, there are five categories of production: A, B - explosive; B, G and D - fire hazardous.

Category A - production where there are: combustible gases with a lower limit of ignition up to 10% of the air volume; liquid with a flash point of vapor up to 28 ° C inclusive (provided that these gases and liquids can form explosive mixtures with a volume of more than 5% of the volume of premises); solids that are capable of exploding and burning when interacting with water, oxygen or air (gasoline, alcohol, calcium carbide warehouses, etc.), gas-generator rooms, areas and departments where work is carried out with paints and organic solvents, and others.).

Category B - production in which there may be: flammable gases with a lower explosive limit of more than 10% of the air volume; liquid with an ignition temperature of 28 ... 61 C inclusive; liquids heated in production conditions to flash points and above; combustible dusts or fibers with a lower limit of ignition up to 65 g / m3 to the air volume. At the same time, these gases, liquids and dust can form explosive mixtures with a volume of more than 5% of the room volume (warehouses of varnishes and paints, cylinders with oxygen or compressed ammonia, workshops for the preparation of herbal flour, mixed fodders, protein and vitamin supplements, dry hay, straw, cake, machine and equipment rooms of ammonia compressor stations, etc.).

Category B - production, where used: liquids with a flash point of vapor above 61 ° C; combustible dust and fibers with a lower explosive limit of more than 65 g / m3 to the air volume; substances that can only burn when interacting with water, oxygen, or air; solid combustible substances and materials (grain dryers, grain elevators, parts of engine diagnostics and repair, garages, carpentry shops, crushing and sifting of concentrated feeds, milk, blood, eggs, etc.).

Category D - production, in which are processed: incombustible materials and substances in the hot and molten state in the presence of emissions of radiant heat, sparks, flames; production with the use of solid, liquid and gaseous substances, burned or utilized as fuel (boilers, smithies, welding sites, thermal, pickling, tinning rooms, machine rooms of freon refrigeration plants, etc.). Category D - production related to the processing of non-combustible substances and materials in the cold state (turning, tool, razborochno-washing workshops, vegetable storage, silos, etc.).

Fire resistance of buildings and structures

The conditions for the development of fire in buildings and structures are largely determined by their fire resistance. Fire resistance means the ability of materials, structures and buildings as a whole to withstand fire, maintain strength, not break down and do not deform under the influence of high temperatures during a fire. The fire resistance limit of building structures is determined by the time in hours and minutes from the start of their fire standard test to the occurrence of one of the limiting states for fire resistance: density - the formation of through cracks or through holes through which the combustion products or flame penetrate;

by thermal insulating ability - an increase in the temperature on the unheated surface on average by more than 160 ° C or at any point of this surface by more than 190 ° C in comparison with the design temperature before the test, or more than 220 ° C, regardless of the temperature of the structure prior to testing; on loss of bearing capacity of structures and units - collapse or deflection, depending on the type of construction. The lowest limit of fire resistance is unprotected metal structures, and the largest - reinforced concrete.

The degree of fire resistance of buildings and structures depends on the group of flammability and the limit of fire resistance of the main building structures. In accordance with the SNiP Fire Standards, buildings can be of five degrees of fire resistance: I, II, III, IV and V. Fireproof buildings of the first and second degrees of fire resistance are the safest in respect of fires. In buildings and structures of I and II degrees of fire resistance all structural elements are fireproof (except for roofs in buildings with attics that can be combustible) with fire resistance limits of 0.5 ... 2 h and 0.25 ... 2 h, respectively.

At the III degree of fire resistance of buildings and objects, only bearing walls, frame, columns, and partitions, inter-floor and attic ceilings can be fire-resistant. They can be from hard combustible materials or from combustible ones, but plastered or treated with flame retardant. In buildings of the IV degree of fire resistance only fire walls (firewalls) that separate large buildings into parts can be fireproof; bearing walls, columns, partitions and the filling of frame walls must be difficult to burn, and the bearing elements of the coatings can be combustible. In buildings V degree of fire resistance, all elements, except firewalls, can be from combustible building materials. In buildings of all degrees of fire resistance it is allowed to make combustible: panel partitions glazed at a height of the blind part up to 1.2 m from the floor, and also collapsible and sliding; floors (except for those rooms where LVS and GZ are used or stored); window bindings, gates and doors, except located in fire walls; facing of walls, partitions and ceilings, lathing of roofs and rafters in buildings with attics; roofing in buildings III, IV and V degrees of fire resistance with attics. Evacuation in case of fire When forced evacuation from buildings and structures, the movement of people instinctively begins in one direction - towards the exits. This leads to a rapid increase in the density of human flows in evacuation passages. With increasing flux density, the speed of movement decreases, so the main indicator of the effectiveness of forced evacuation is the time during which people can leave separate premises and buildings as a whole, if necessary. The safety of involuntary evacuation is achieved when its duration is shorter than the time it takes to reach the critical conditions for a person: a critical temperature (60 ° C), a decrease in the concentration of oxygen, accumulation of toxic combustion products in the air above permissible levels, and loss of visibility due to smoke. The timing of the occurrence of these critical conditions depends on the specific circumstances and can be calculated. Reduction of the evacuation time is achieved by constructive planning and organizational solutions.

The main parameters of evacuation from buildings and structures: density, speed of movement of the human flow, the capacity of paths (exits) and traffic intensity. In addition, evacuation routes (both horizontal and inclined) are characterized by length and width. Maximum allowable length of the evacuation area, m, Ln = vT, where V is the speed of people's movement in emergency evacuation, m / min: 16 - on horizontal sections, 8 - on the stairs upwards, 10 - on the stairs downwards; T - allowable evacuation time, min: 6 - from buildings of I and II degrees of fire resistance, 4 - from buildings of III and IV degrees of fire resistance, 3 - from buildings of V degree of fire resistance. For children's institutions, the evacuation time is reduced by 20%.

The permitted length of evacuation routes should not be more than 50 m in single-storey production buildings of I and II degrees of fire resistance with production of category A and not more than 100 m in buildings of categories B and B. In multi-storey industrial buildings, these distances are respectively 40 and 75 m. To calculate the area / horizontal projection of a person take, depending on his age, type of clothes and carry the load of the following relationships:

1. f, m2 Adult:

- in summer clothes 0,1 in demi seasonal clothing 0,113

- in winter clothes 0,125
- with a child in his arms 0,285
- with a backpack of 0.315
- with a light convolution of 0.235

2. Teenager 0.07
3. Child 0.04 … 0.05

At Д <0,05 м2 / м2 the person has full freedom of movement both in a direction, and on speed desirable to it. With a population density of 0.05 <Д <0.15, people can not freely change their direction of movement, and at Д≥0.15 m2 / m2 people begin to move indissolubly. Therefore, in calculations, the value of Δ ≤ 0.9 m2 / m2 should be ensured.

Fig. 10.2. Fire stairs of a multi-storey building

The throughput of the paths, m2 / min (or person / min), is the number of people passing per unit time through the cross-section of the path:

$$Q = DvB,$$

where B is the width of the evacuation area, m.

The intensity of the flow of human flow, m / min, q = Av. At Д≤0,9м2 / м2 the traffic intensity of the flow of people q should correspond to the following values, m / min, not more: 13.5 - for the horizontal path; 8.5 - for doorways with a width of 1.6 m (or more); 7,2 - on the stairs down; 9,9 - up the stairs. Estimated width of the evacuation section, m, Bp = N / (Lpδ),

where δ is the density of the flow of people along the length of the site, person / m2: for adults 8 ≤ 10 ... 12, for children 8 ≤ 20 ... 25. The value of 8 can also be determined from the formula: δ = N / S. The width B of the evacuation areas is taken in accordance with Table 30.1, taking into account the estimated value of Bp. Number of evacuation routes ee = 0.6N / (100B). The resulting value is rounded up, but in any case the following condition must be met: pe ≥ 2. 30.1. The width of the aisles, corridors, doors, marches and staircases, m Evacuation area Lowest value Highest value Passage Corridor Door March

Note. The width of passages to single workplaces, as well as staircases to galleries, floors, platforms may be reduced to 0.7 m; the width of marches and platforms of stairs to basements and attics, as well as stairs intended for the evacuation of less than 50 people - up to 0.9 m. Number of gates for the evacuation of animals from the premises:

$$nв = Nж / (PC)$$

where Nj is the total number of animals contained in the room; P is the number of animals per 1 m of the width of the outlet (Table 30.2); C-gate width, m: for barns and stables ≥ 2 m, for ovcharins ≥ 2.5 m, for pigs ≥ 1.5 m. Allowable number of animals per 1 m of evacuation exit width Kind of animals.

The degree of fire resistance of buildings II, III IV, V Cows 30-20, Horses 25-15.

Pigs: uterus with litter and boars 25-15 livestock and young fattening 250-150.

Sheep 200-120

In cattle-breeding premises there must be at least two exits (gates). If possible, they should be arranged in opposite sides of the premises.

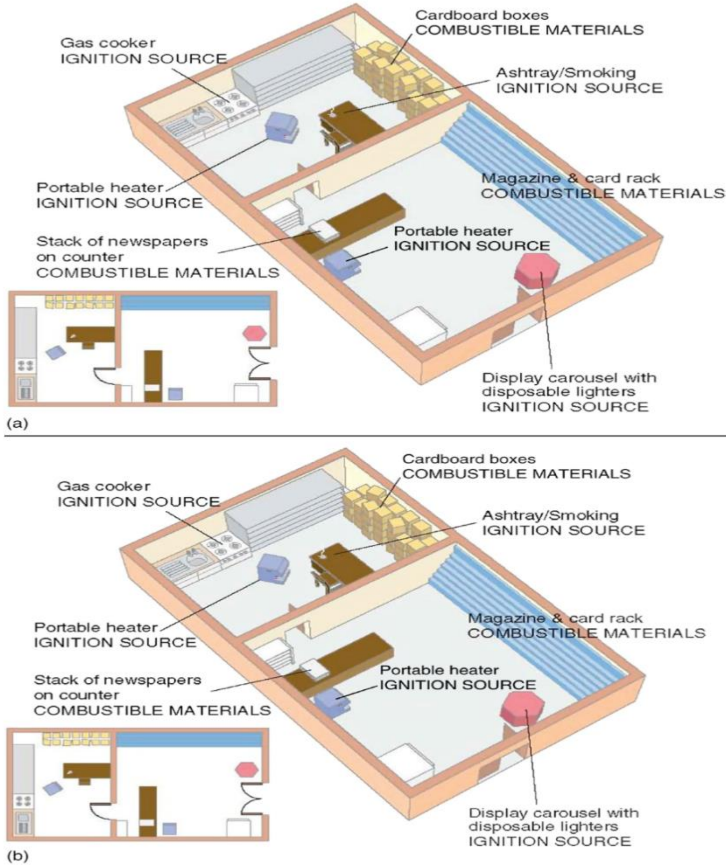


Fig. 10.3. Fire hazard assessment. a) Assessment of the risk of fire in advance. b) Fire risk assessment after

Fig. 10.4. Diagram of fire evacuation

Barriers against fire

A fire prevention system is a set of organizational measures and technical means aimed at eliminating the conditions for the occurrence of fires. Such a system should be developed for each production facility on the basis that the normative probability of a fire or explosion does not exceed 10 ~ 6 per year for a separate fire hazard unit (element) of the facility or an explosive area. At the same time, the probability of exposure to hazardous explosion factors on humans should also be no more than 10 ~ 6 per person.

Prevention of fires and explosions in production is achieved by excluding the possibility of formation of a combustible and explosive atmosphere, as well as by preventing the occurrence of ignition sources in a combustible medium (or entering into it). To solve these problems, the necessary attention should be paid both at the stage of designing buildings, structures, technological processes and production equipment, and in the process of work of plots, workshops and enterprises in general.

Prevention of the formation of a flammable environment is ensured by:

- maximum mechanization and automation of production processes associated with the formation of combustible substances;
- sealing equipment on which flammable substances are handled, and packagings for them;

- as much as possible replacement of combustible materials and substances used in technological processes with flammable and non-combustible;
- installation of fire and explosion-proof equipment in isolated premises;
- regulating MPC of combustible substances or explosive dusts;
- control of the composition of the air in the rooms, the working environment in the vessels and apparatus;
- discharge of flammable medium to special devices and safe places;
- use of inhibiting and inert additives to reduce the concentration of fire and explosive substances in the air in industrial premises and work areas;
- increase of humidity of processed raw materials and materials;
- keeping clean the internal surfaces of buildings, structures and territory of enterprises;
- monitoring the health of heating appliances, chimneys, etc.

The possibility of a fire or explosion due to formation in a combustible environment (or introduction into it) of ignition sources is excluded when two basic conditions are met:

- The energy of the ignition source must be less than the energy, necessary for ignition of a given combustible mixture, taking into account the safety factor;
- the temperature of the surfaces of equipment, materials, enclosing structures, achieved during technological processes, should be less than the autoignition temperature of the relevant substances, materials or combustible media contacting these surfaces.

Preventing the formation of ignition sources in a combustible environment is achieved by: applying machinery and equipment that do not allow the formation of an ignition source and optimizing their operation modes; operation in fire and explosion hazardous areas of the relevant electrical equipment; a device for lightning protection of buildings and structures; using an intrinsically safe tool; elimination of spontaneous combustion of substances and materials; control of the heating temperature of the surfaces of equipment, products and materials that can come into contact with a combustible medium; compliance with the rules for the performance of fire works; the implementation of measures to protect against discharges of static electricity, etc.

Safety measures for gas-electric welding work General information. Welding works are referred to the category of work with increased danger, which determines the appropriate requirements for the organization and equipment of workplaces, serving welding machines and installations to personnel. Welding works are allowed for males not younger than 18 years old, who have undergone a medical examination and are recognized as fit for these jobs, who have received special training, introductory and primary workplace briefings on safety and with appropriate certificates.

Welders and ancillary workers are given overalls, special footwear, safety devices and eye protection. The premises of welding sections are isolated from other production and auxiliary premises. The floors on the welding areas are made of fire-resistant and low-heat-conducting materials, non-slip and smooth. In the case of finding more than 5 m from the welding posts of wooden partitions, their surface is plastered, and the door, opened only to the outside, is covered with fireproof material.

The welding booth should be sufficiently free to accommodate the necessary equipment, hardware and have at least 4.5 m2 of free space. The permanent workplace of the welder is equipped with a table or device to hold and move the workpiece, as well as a height-adjustable seat with a backrest. Welding posts are equipped with devices for laying electric holders or rack with a hook, or a fork to suspend the extinguished burners and torches during breaks in work. In the rooms of welding areas there must be supply and exhaust ventilation, and on welding posts - local suction.

In some cases, when welding small parts with the seated position of the welder, a small inclined lateral suction or shelter under the table with holes in its lid is allowed. Metal products coming in for welding or gas cutting must be carefully cleaned from paint, oil, scale and dirt for a width of at least 100 mm on either side of the seam. Do not use a gas flame. Welding works in closed containers are classified as a category of work of increased danger, for which the order-admission is obligatory. The order is issued by the immediate supervisor of the work for one day after the purposeful briefing.

Welding in closed containers is entrusted to the brigade consisting of at least three people, including the foreman. Welder except for overalls (rubber gloves, galoshes, dielectric helmet) give a hose gas mask, a rescue belt with shoulder straps and a ring at their intersection behind with a rope tied to it, tested for breaking with a force of at least 2250 N, 2 m longer than the depth capacity, with nodes located at a distance of 0.5 m relative to one another. A free end of the rope is held by one of the members of the brigade, which is located outside the container. Welding works are carried out only with open covers, hatches, etc.

To protect the surrounding workers from the effects of ultraviolet radiation, the workplaces of electric welders are insulated with strong and light fences on no less than three sides. Over welding posts located in the open air, arrange canopies of non-combustible materials. If there are no such canopies, then work in the rain or snow falls.

The combustion of dusty substances and gases in the air

Gases form a flammable mixture when mixed in a certain amount with air. Liquids and solids form flammable mixtures if they are heated to a temperature at which evaporation or decomposition produces vapor-gas-like products in sufficient quantities. The dust of solids that air in the air ignites, provided that its aerosol with a certain density saturates the air. The fire and explosion hazard of substances is estimated on the basis of a comparison of the probability of their burning under equal conditions and for gases is characterized by the following indices: concentration ignition limits, minimum ignition energy, combustion temperature and flame propagation velocity;

for liquids, in addition, the temperature of autoignition, and for solids and dusts - additionally the temperature of self-heating, the ability to explode and burn when interacting with air oxygen, water and other substances. Gas-air mixtures ignite only in a certain range of concentrations of a combustible substance, the boundaries of which are called the lower and upper concentration limits of ignition.

The lower concentration limit of ignition is the lowest concentration of combustible gas (dust) at which the mixture is already capable of igniting from the ignition source and the flame spreads over the entire volume of the mixture. The upper concentration limit of ignition is the highest concentration of combustible gas, at which the mixture is still capable of igniting from the ignition source, and the flame spreads over the entire volume of the mixture. Concentration limits of ignition depend mainly on the content of inert components in the mixture (carbon dioxide, nitrogen, etc.), as well as on its division and temperature. As the pressure and temperature increase, the region of ignition of the combustible mixtures expands, decreases with decreasing pressure. To calculate the lower (NI) and upper (VP) limits, the ignition of individual combustible substances can use the following empirical formulas (in vol%):

$$НП = \frac{100}{1 + (N - 1)4,76};$$

$$ВП = \frac{400}{4 + 4,76N},$$

where N is the number of moles - oxygen atoms involved in the combustion of 1 mole of fuel. For a complex gas-air mixture of a known composition, the ignition limits can be calculated from the Le Chatelier formula (in vol%):

$$\Pi = \frac{100}{\frac{C_1}{\Pi_1} + \frac{C_2}{\Pi_2} + \cdots + \frac{C_n}{\Pi_n}},$$

where P is the limit of ignition (lower or upper). % vol: C1, C2, Cn - concentration of combustible components in the combustible mixture, C2 + C3: + ... + C = 100% об .; П1, П2 Пn - the corresponding limits of ignition of pure components of the mixture,%, vol. The minimum ignition energy is the smallest value of the energy of an electric discharge (mJ), which is sufficient to ignite the most flammable mixture of a given gas, steam or gas with air.

The most fire and explosive are gases with a wide ignition region, low lower concentration limit of ignition, small ignition energy, greater normal flame propagation velocity.

Combustion of liquids is the combustion of the vapor-air phase formed over their surface as a result of evaporation.

The flash point is the lowest (under special test conditions) temperature of the liquid, at which vapor or gases are formed above its surface, capable of flashing from a foreign source of ignition. It is one of the main parameters that determine their fire hazard. After combustion of the steam-air mixture, combustion ceases, since the surface of the liquid does not warm up to the temperature, it is taken out by the internal one for its further rapid evaporation.

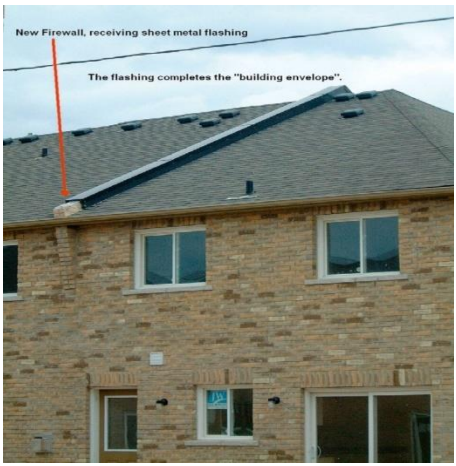


Fig. 10.5. Fire wall between houses

The ambient temperature, equal to the flash point, is the limit at which the liquid becomes particularly dangerous in the fire relation. Its value serves as a criterion for the classification of flammable liquids according to the degree of their fire hazard. Depending on the flash point, the vapors of the liquid are divided into two classes:

I class - flammable liquids (LVS), that is, liquids that can burn independently after removing the ignition source and have a vapor flash point in a closed crucible not higher than 61 or 66 ° C in the open (ethyl alcohol, ethers, benzene, etc.);

II class - flammable liquids (GG), which have the ability to fist at temperatures exceeding these (lubricating oils, glycerin, vegetable oils, etc.).

The ignition temperature is the lowest temperature at which the liquid emits flammable vapors at a rate sufficient to continue stable combustion after ignition. Autoignition temperature is the lowest temperature of liquid vapor at which the rate of exothermic reactions sharply increases, leading to flame burning without an external source of heat.

The autoignition temperature determines the group of the explosive mixture, on the basis of which the explosion-proof electrical equipment is selected, the temperature conditions for the safe use of the substance; maximum permissible heating temperatures of non-insulated surfaces of process, electrical and other equipment. To determine the conditions for the safe storage of substances that have the ability to self-ignition, as well as to choose the optimum regimes for their treatment, the self-heating temperature, i.e., the lowest temperature at which, in a substance in the air atmosphere, there are exothermic processes of oxidation, decomposition, etc. Self-igniting substances by the nature of possible chemical reactions can be divided into the following groups: spontaneously combustible in contact with air, in contact with water, with mixing or contact (incompatible substances), decomposed by temperature, impact and friction.

The substances self-igniting in contact with air include vegetable oils, animal fats and products prepared on their basis or with their addition (sunflower oil, drying oil, paints, varnishes, wiping compounds, etc.). They are oxidized by atmospheric oxygen at ordinary or elevated temperatures. To inflammable or causing burning in contact with water are the following substances: sodium, potassium, calcium carbide, quicklime, etc.

Fig. 10.6. Main insulation panels of buildings

The temperature of decay is the lowest temperature at which the rate of exothermic reaction increases, resulting in the appearance of decay. Fire and explosive properties are also the dust of certain substances, which can be located in the industrial premises of the airgel and aerosol. The fire hazard properties of dusts are determined by the autoignition temperature and the concentration limits of their ignition.

The ignition and explosion of organic dust suspended in air depend on its mass concentration, particle size, ash content, humidity, ignition temperature, the nature and duration of the heating source. The chemical activity of aerosols of mill-elevator, feed, sugar, starch industry and the production of dextrin is especially great. There are two forms of burning dust: smoldering and burning with flame. Possessing poor thermal conductivity, the dust settled on the lighting fixtures, hot pipelines, overheats and begins to smolder at the temperature: wheat-290 ° C, rye-350 ° C. When it is cocked, it can explode like a normal aerosol. The aerosol is ignited at a temperature of 430-450 ° C (rye dust), 420-485 ° C (wheat dust).

For fire and explosion hazard, all dusts are classified as follows:

I class (the most explosive) - with a lower concentrated explosion limit of 15 g / m3 (wheat dust coarsen, mill gray dust, powdered sugar, starch, dextrin);

II class (explosive) - with the lower concentration section of 16-65 g / m3 (millet and grain retreat, wheat grass, barley flour, flour dust);

III class (the most fire-dangerous dust) - with a self-ignition temperature of less than 250 ° C (dust of grain cleaning units);

IV class (fire-hazardous dust) - with an ignition temperature of more than 250 ° C (elevator dust).

The autoignition temperature of the aerosol is much higher than that of the airgel, and even exceeds the autoignition temperature of vapors and syringes, since the concentration of combustible matter per unit aerosol volume is hundreds of times smaller than that of airgel.

For dusts, only the lower concentration limit is usually determined, since the upper concentration limit (VCRV) is never reached. So, for example, the upper concentration limit of ignition of sugar dust is 13500 g / m3.

Means, methods of control and fire fighting

In order to prevent or stop burning, one must exclude one of the three necessary conditions: a combustible substance, an oxidant or an ignition source. To do this, apply the following methods:

- terminate the access of the oxidant to the combustion zone or to the combustible substance or reduce its incoming volume to the limit at which combustion becomes impossible;
- reduce the temperature of the burning substance below the ignition temperature or cool the combustion zone; inhibit (inhibit) the burning reaction;

- mechanically tear off (detach) the flame with a strong jet of extinguishing agent.

Substances or materials capable of stopping combustion are called fire extinguishing agents. These include water, chemical and air-mechanical foam, aqueous solutions of salts, inert and non-flammable gases, water vapor, halogen-hydrocarbon mixtures and dry solids in the form of powders.

Extinguishing media are classified according to the following characteristics:

- by the method of cessation of combustion - cooling (water, solid carbon dioxide, etc.), diluting the concentration of the oxidant in the combustion zone (carbon dioxide, inert gases, water vapor, etc.), which isolate the combustion zone from the oxidizer (powders, foams and etc.), inhibiting halogen-hydrocarbon mixtures, in the composition of which may include tetrafluorodibromoethane (chladone 114B2), trifluorobetanethane (chladone 13B1), methylene bromide, and also compositions based on ethyl bromide (3.5; 4ND; SSB; BF);

- the numbers in the designation of the compositions indicated by the latter show how many times they are more effective than carbon dioxide]; for electrical conductivity - electrically conductive (water, chemical and air-mechanical foams) and non-conductive (inert gases, powder formulations);

- for toxicity - non-toxic (water, foam, powders), low-toxic (CO2, N2) and toxic (C2H5Br, etc.).

Water compared with other extinguishing agents has the greatest heat capacity and is suitable for extinguishing most combustible substances. When 1 liter of water is heated from 0 to 100 ° C, 419 kJ of heat is absorbed, and during evaporation, 2258 kJ. Getting to the surface of the burning substance, the water heats up and evaporates, taking the appropriate amount of heat and lowering its temperature. The evolved steam has a volume that is 1700 times greater than the volume of water, so it sharply reduces the concentration of oxygen in the combustion zone and hinders the access of the oxidant to the combustible material. When water is supplied under high pressure, the effect of mechanical flame failure is achieved, and the liquid that has evaporated does not flow to neighboring materials that have not yet burned, making it difficult to ignite them. To extinguish substances that are poorly wetted with water (peat, packaged in bales of wool, cotton, etc.), surface-active substances are introduced into it to reduce the surface tension, such as wetting agents DB, NB, foaming agents PO-1, PO-1D , sulfonyl, soap, etc.

In addition to such advantages as high efficiency, wide availability and low cost, the water has inherent drawbacks that limit its use. Water can not be extinguished by live electrical equipment, liquid combustibles of lower density, as well as materials that deteriorate or decompose under its action (for example, books or calcium carbide, releasing explosive and flammable gas - acetylene). A significant drawback is considered and the ability of water to turn into ice with a decrease in its temperature to 0 ° C or less.

Water vapor is used to extinguish fires in rooms up to 500 m3, as well as small fires in open areas and installations. Steam moistens burning objects and reduces the concentration of oxygen in the combustion zone. The fire retardant concentration of water vapor is approximately 36% by volume. Foams are widely used to extinguish LVS and GZH with a density of less than 1000 kg / m3. Foam is a system in which the disperse phase is always gas. Gas bubbles can form inside the liquid as a result of chemical processes (chemical foam) or mechanical mixing of air with liquid (air-mechanical foam). The smaller the gas bubble sizes and the surface tension of the liquid film, the greater the mechanical stability (low probability of destruction) of the foam. Density of chemical foam ranges from 150 to 250 g / m3, and air-mechanical - 70 to 150 kg / m3, so the foam of both types freely float on the surface of flammable liquids, not dissolving in it, cooling the surface and isolating it from flame. The ability of the foam to retain well on vertical and ceiling surfaces makes it indispensable in a number of cases when extinguishing fires. However, foam, like water, has electrical conductivity, which limits its use.

Air-mechanical foam is obtained by mixing water into which a foaming agent is added, with air in foam generators, air-foam barrels and fire extinguishers. Foamers are substances that are in a colloidal state and are capable of being adsorbed in the surface layer of the solution at the liquid-gas interface. The foaming agents PO-1, PO-1D, PO-1C, PO-6K, and frost-resistant (up to -40 ° C) "Morozko" software are used. Air-mechanical foam is absolutely harmless for people, does not cause corrosion of metals, has high economy.

Chemical foam is formed by the interaction of alkaline and acid solutions in the presence of foaming agents. It is a concentrated emulsion of carbon dioxide in an aqueous solution of mineral salts. Such foam is obtained with the help of foam generators or chemical foam extinguishers. Due to the high cost and complexity of the preparation, chemical foam is increasingly replaced by air-mechanical foam. Extinguishing media that are under normal conditions in the gaseous state include carbon dioxide, nitrogen, inert gases (argon, helium), water vapor and flue gases.

Their fire-extinguishing concentration in the air is in the range of 30 ... 40%. Quickly mixing with air, these gases lower the concentration of oxygen in the combustion zone, take away a significant amount of heat and inhibit the intensity of combustion. Carbon dioxide (CO2) is used for rapid (within 2 ... 10 s) quenching of fire-fighting internal combustion engines, electrical installations, small quantities of flammable liquids, as well as to prevent ignition and explosion when storing LPG, manufacturing and transportation of combustible dusts (coal and etc.).

Carbon dioxide is stored in a liquefied state in cylinders, including fire extinguishers. When it comes out of the balloon, it expands very much and, cooling, turns into a solid state, forming white flakes with a temperature of -78.5 "C. By taking heat from the combustion zone by the amount of 570 kJ per 1 kg of solid matter, carbon dioxide heats up and passes into a gaseous state - carbon monoxide (carbon dioxide) .As carbon dioxide is about 1.5 times heavier than air, it pushes oxygen away from the burning substance, stopping the combustion reaction.

Carbon dioxide can not be used to extinguish alkali and alkaline earth metals (because it reacts with them chemically), ethyl alcohol (in which carbon dioxide dissolves) and materials that can burn without access to air (celluloid, etc.). When using CO2, it is necessary to remember its toxicity at small (up to 10%) concentrations, and that 20% of carbon dioxide in the air is lethal to humans.

Inert, flue gases and exhaust gases of internal combustion engines are most often used to fill vessels and containers in order to avoid a fire when performing welding operations.

Halocarbon compounds (gases and volatile liquids) are compounds of carbon and hydrogen atoms in which the hydrogen atoms are partially or completely replaced by halogen atoms (fluorine, chlorine, bromine). The fire-extinguishing effect of such compounds is based on chemical inhibition of the combustion reaction, therefore they are also called inhibitors or phlegmatizers. The halocarbon-containing compounds have a high density, which increases the efficiency of fire extinguishing, and low freezing temperatures, which allow using them at negative air temperatures (on a Celsius scale).

A significant disadvantage of such formulations is their toxicity by inhalation and skin contact. In addition, ethyl bromide and its compounds can burn under certain conditions, which limits their use. Solid extinguishing agents in the form of powders are used to eliminate small fires of ignition, as well as combustion of materials that can not be quenched by other means.

Powders are finely divided mineral salts with various additives that prevent their caking and clumping (for example, with talc) and promote melting (with sodium chloride or calcium, etc.). Such compounds have a good fire-extinguishing ability, several times higher than the ability of halocarbons, and the versatility by which the burning of most combustible substances ceases.

On the burning surface, the extinguishing powders create an anti-burning layer, and the incombustible gases released by the decomposition of certain constituents of powders (soda and similar substances) enhance the quenching efficiency. The most common powders are sodium bicarbonate (PSB-3), diammonium phosphate (PF), ammophos (P-1A), 114B2 silica gel (SI-2), and others. In the combustion zone, the powders can be fed by compressed carbon dioxide, nitrogen or mechanically.

Fig. 10.7. Appearance of fire extinguishers of marks OU-2, OU-2A, OU-5, OU-5MM, OU-8, filled with gas CO_2.

A fire extinguisher is a device for extinguishing a fire by issuing an extinguishing agent after it is activated. There are fire extinguishers of various types: chemical foam, carbon dioxide, bromoethyl, air-foam and powder. The chemical foam fire extinguisher OXP-10 (Figure 10.8, a) consists of a steel casing 7 containing 9 l of a water-alkaline solution (sodium bicarbonate $NaHCO_3$ + liquorice extract) and a polyethylene beaker

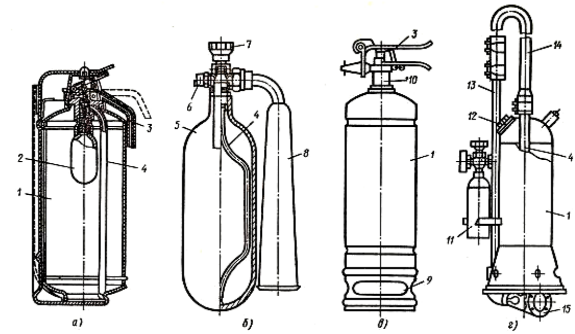
2 with an acidic mixture (sulfuric acid H_2SO_4 + iron sulfide $FeSO_4$, boosting volume and strength of the foam). To bring the fire extinguisher into operation, it is taken with one hand by the handle 4, and the other hand turns the handle 5 upwards by 180 °, which opens the valve 3, connecting the alkaline and acid parts through the holes 8. After that, the fire extinguisher is turned upside down and directed by the outlet branch pipe 7 to the flame. Soda begins to interact with the acid compound. The carbon dioxide that forms as a result of the chemical reaction foams the contents of the fire extinguisher and throws out 55 liters of foam over a distance of 6 ... 8 m for 1 minute. The released foam separates the burning surface from the oxygen of the air and cools it.

The chemical air-foam fire extinguisher OXVP-10 (Figure 27.4, b) is similar in design to OXP-10, differing only in the presence of a nozzle 11 with a grid 12 at the inlet 7 to increase the volume of the foam. When passing through the nozzle, the chemical foam is mixed with air coming through the windows 10.

The fire extinguisher OVP-10 (Figure 27.5) consists of a steel casing 1, a lid 4 with a shut-off device, a can of 8 with compressed carbon dioxide and a siphon tube 9. A 6% foaming agent PO-1 is used as the working charge. The starting device includes a start lever 6 and a rod 7c with a needle. When the trigger is pressed, the needle of the rod 7 pierces the membrane of the can 8.

The carbonic acid emerging from the canister creates a pressure in the housing, under the action of which the solution of the foaming agent is pushed through the nozzle where, with mixing of the liquid emerging from the housing with air, an air-mechanical foam forms. Carbon dioxide fire extinguishers are most often used to extinguish fires in book storages and electrical installations, since carbon dioxide unlike chemical foam does not conduct electric current and, in addition, does not destroy books and other material values.

The carbon dioxide fire extinguisher OU-2 (Figure 10.8) is produced in two versions, differing by shut-off and starting devices. The fire extinguisher shown in Figure 10.8, a, consists of a steel cylinder 1 with a capacity of 2 liters, a valve 4 and a bell 5. In a cylinder under pressure of about 6MPa there is 1.5kg.



10.8. Diagrams of carbon dioxide fire extinguishers: 1 - a cylinder; 2- handle; 3 - fuse diaphragm; 4 - the valve; 5 - the bell; 6 - siphon tube; 7 - check valve; 8 - stem; 9 - the starting lever; 10 - safety check for liquid carbon dioxide.

Membrane 3 of the fuse is designed to break when the pressure in the cylinder rises to 22 MPa. To bring the fire extinguisher into operation, it is necessary to take it with one hand by the handle 2, and another to direct the socket 5 to the burning object and then open the valve 4. Liquid carbon dioxide, leaving through the socket 5, expands and at the same time cools down to form white snow-like flakes. A jet of gas and snow with a length of 1.5 m reduces the concentration of oxygen and combustible vapors in the combustion zone and cools the surface of the burning substance.

Fire extinguisher is valid for at least 30 seconds. Do not hold the cylinder in a horizontal position or turn it over, since the effectiveness of the fire extinguisher is reduced. To activate the carbon dioxide fire extinguisher shown in Figure 10.8, b, it is necessary to pull out the safety pin Yun by pressing the start lever 9 which opens the shut-off valve 7. After that, carbon dioxide passes through the siphon tube 6, the socket 5 and is ejected outwards.

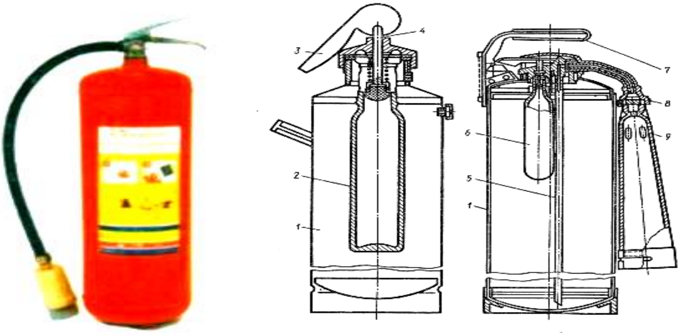


Fig. 10.9. Scheme of fire extinguisher OUB-3:
1 - housing; 2 - siphon tube; 3 - the valve; 4 - nebulizer; 5-rod; 6- starting handle

Fire extinguishers OU-5 and OU-8 differ from OU-2 with the capacity of the cylinder (5 and 8 liters, respectively) and the length of the jet (2.5 and 3.5 m). During operation, fire extinguishers are periodically weighed to make sure that they are not self-discharged. If the weight is less than 6.25 kg for OU-2, 13.25 kg for OU-5 and 19.7 kg for OU-8, the fire extinguisher must be recharged. OGB-3 (figure 10.9) and OUB-7 (the figure in the marking means cylinder capacity in liters) contain a charge consisting of 97% of ethyl bromide and

3% of liquefied carbon dioxide. To discharge the charge from the balloon, air is injected into it at a pressure of 0.843 MPa at 20 ° C.

The fire extinguishers have a duration of 35 s, the length of the jet is 3 ... 4.5 m. Fire extinguishers of the OUB type are more effective than carbon dioxide fire extinguishers, but so far they are not widely used due to the ability of ethyl bromide to form explosive concentrations with air, but mainly because of the toxicity of the contents. Therefore, when using such extinguishers in closed volumes, insulating masks should be used.

Brometyl-chladone fire extinguishers are less affected by the deficiencies of carbon dioxide-bromoethyl fire extinguishers, which is why they are gradually replacing the latter.

Fig. 27.8. Powder fire extinguishers.

Brometil-Khladonov fire extinguisher OBX-3 for the device and the principle of operation is similar to OUB-3. The simplest fire extinguishers of this type, produced by Halogen, are designed to extinguish small fires in the home and equip vehicles. Such a fire extinguisher is a conventional aerosol can, to actuate which it is sufficient to remove the lid and press the spray head.

Powder extinguishers consist of a plastic or metal casing, filled with a special powder. The basis of the powders are salts, to which substances preventing the formation of lumps and promoting melting, as well as dyes such as ocher, are added. Getting on the burning surface, the powder creates a layer that isolates it from oxygen.

Fire extinguisher OP-1 "Moment-2P" intermittent and repeated use (Figure 10.8, a) is a body 7 in which the powder composition is located and a screw head 10 screwed onto the body.

To bring the fire extinguisher into operation, it is necessary to lift the lever 9 sharply upwards. At the same time, the lever shank pushes the rod 7. The stem, overcoming the resistance of the spring, moves downward, opens the valve 5 and pierces the membrane of the cartridge 3 with compressed carbon dioxide. Carbon dioxide passes through the siphon tube 2 into the body of the fire extinguisher and creates a pressure sufficient to discharge the powder through the slit nozzle 6. By lowering the lever 9 down, the work of the fire extinguisher can be suspended.

Fig. 10.10. Fire protection devices - water hose, fire extinguisher, fire blanket

In the neck of the case.

1 (Figure 10.10, b) of the fire extinguisher OP-1 "Sputnik" is a mesh sprayer

2. The neck is closed by a lid 3 on the thread.

To extinguish the fire, it is necessary to unscrew the cover and, sharply shaking, throw the powder through the mesh sprayer. As a result of such actions, a fog-preventing cloud is created.

To activate the OP-5 fire extinguisher (Figure 10.8, c), it is necessary to break the seal, pull out the check 5 and press the lever 6. The rod with the needle 8, moving down, pierces the membrane of the canister J? Co with compressed carbon dioxide. The gas passes through the tube 2 to the body 7 of the fire extinguisher and creates pressure therein, whereby the powder composition, when the handle 11 of the locking pistol 10 is pressed, passes through the flexible rubberized hose 9 and is discharged through the spray nozzle 12.

Fig. 5.13. Special gas fire extinguishers OU-25, OU-40, OU-80, OU-400, operating on CO2.

Powder fire extinguishers are most often used in the event of fire in cars, buses and tractors. There is a variety of powder fire extinguishers - self-extinguishing. For example, the fire extinguisher OSP-1 is a glass flask in a metal frame 500 mm long and 54 mm in diameter, filled with powder. In the middle of the bulb there is an interlayer of a special solid substance, passing into a gaseous state at a temperature of 100 ° C. The pressure created at this temperature breaks the flask, which leads to an impulse release of the powder, which is scattered in a space of 5 ... 8m3, falling asleep with a source of fire.

Such fire extinguishers are effective in small-scale rooms (in closed electrical distribution devices, small warehouses, utility rooms, garages, etc.). When manually using fire extinguishers such as OSB, the flask is smashed from one of the ends and the burning area is covered with powder. The choice of type and calculation of the required number of fire extinguishers depend on their fire-extinguishing ability, the maximum area and fire class according to ISO 3941-77.

Class A includes fires of solid substances, mainly of organic origin, the combustion of which is accompanied by decay (wood, paper, textiles); to class B - fires of flammable liquids or melting solids; to class C - fires of gases; to class D - fires of metals and their alloys; to class E - fires associated with the combustion of electrical installations. The choice of the type of fire extinguisher (mobile or manual) is due to the size of possible fires. If their size is large, mobile fire extinguishers should be used. It should also ensure that the temperature limits for using the fire extinguisher match the climatic conditions of operation of the building or structure.

In rooms equipped with automatic fixed fire extinguishing installations, 50% of fire extinguishers are provided from their calculated number. The distance from the possible source of fire to the location of the extinguisher should not be more than 20 m for public buildings and structures; 30 m for premises of categories A, B and C; 40 m for premises of categories B and D; 70 m for rooms of category D.

Placement of primary fire-extinguishing means in corridors, passageways should not prevent safe evacuation of people. They should be located in prominent places near the exits from rooms at a height of not more than 1.5 m. Fire fighting panels (points) must be equipped to place primary fire-extinguishing means in production and storage facilities, as well as on the territory of facilities.

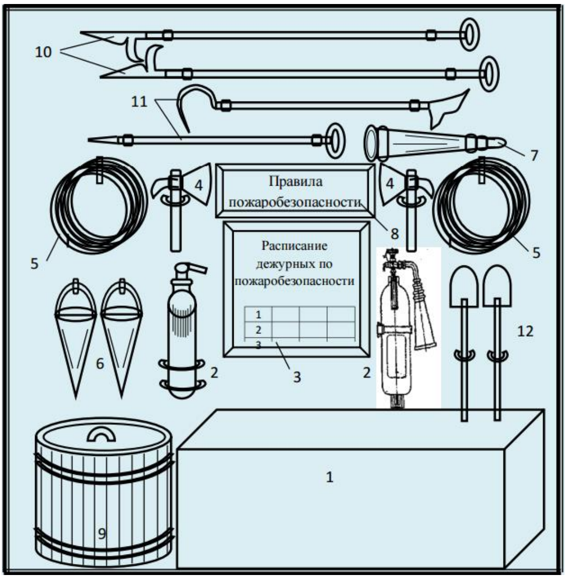


Fig. 10.11. Fire-fighting "rear" and order of attached devices: 1-container with sand, 2-fire extinguisher foam and with CO_2, 3-schedule firemen on duty, 4-taps, 5 fire extinguishing hoses, 6-cone bucket, 7-water barrel, 8-fire safety rules, 9-water barrel, 10-hook shovels, 11-scrap and hook, 12-shovels.

Air-mechanical foam

Foams used to extinguish a fire are a mass of gas bubbles enclosed in thin shells of liquid. Spreading on the burning surface, the foam isolates it from the flame, as a result of which the flow of vapors into the combustion zone and cooling of the upper layer ceases. The composition of the foam can be chemical and air-mechanical.

Chemical foam is used to extinguish flammable and combustible liquids and other substances that can be extinguished with water. Use it mainly in fire extinguishers. Chemical foam is formed by mixing dissolved in water alkali (with foaming additives) with acid. Disintegrating on heating, it releases carbon dioxide, which reduces the concentration of oxygen in the combustion zone. Chemical foam is much lighter than flammable liquids, and therefore, floating on the surface, it blocks the escape of vapors of burning liquid into the combustion zone and extinguishes the fire. Air-mechanical foam is used to extinguish closed volumes (oil baths, pump-accumulator stations) due to its ability to maintain its structure for a long time and speed of delivery to the fire. It is a colloidal system consisting of air bubbles, the shells of which consist of water with the addition of a special foaming agent. The fire-extinguishing effect of air-mechanical foam is based on the cooling of the fire, as well as on the insulation of the combustion zone from the access of air from outside. Air-mechanical foam is obtained with the help of foam generators. Water flows through the mains to the generator, where a small amount of foaming agent also enters.

In the vortex chamber of the generator, air is mixed and entrapped from the atmosphere. At the exit of the foam generator in the nozzle, the mixture is expanded and foamed. The foam generators produce different capacities and with different foam multiplicities (20 ... 200 and higher). Air-mechanical foam is harmless to people, does not cause corrosion of metals, almost non-conductive and economical. Special dosing devices with foam heads are used in sprinkler and deluge automatic fire extinguishing installations with air-mechanical foam.

THEME 11
TECHNICAL MEANS OF FIRE FIGHTING AND THEIR TASKS

Fire trucks, depending on the purpose, are divided into basic and special. The main ones are machines intended for supplying fire extinguishing substances to a fire: fire trucks, fire pump stations with a hose car, firefield air cars, auto pumps and pump-sleeper cars, fire cars for foam, carbon dioxide, powder and gas-water extinguishing, fire planes and helicopters, fire ships and boats, fire trains and trolleys, fire tanks, fire engine pumps.

Special machines are intended for performing special works in fire extinguishing: fire ladders and crank lifts, fire trucks, automotive communications and lighting, fire fighting vehicles of technical, gas and water protection and water protection services, as well as staff and operational vehicles equipped with a siren signal and light signal. (Figures 11.1-11.2-11.3).

Fig. 11.1. Truck crane

Fig. 11.2. Tanker

Fig. 11.3. Autoglass AL-50

Automatic fire detection and communication system For rapid and successful extinguishing of fires, it is important to detect them as soon as possible in order to timely include automatic means of extinguishing or calling fire departments to the place of ignition. Fire detectors by the method of inclusion are manual and automatic.

Fig. 11.4. Temperature Fire Detector

The manual action detectors, depending on the way they are connected to the receiving stations, are divided into beam and stubborn ones. In beam systems, each detector is connected to the receiving station by a pair of independent wires forming a separate beam.

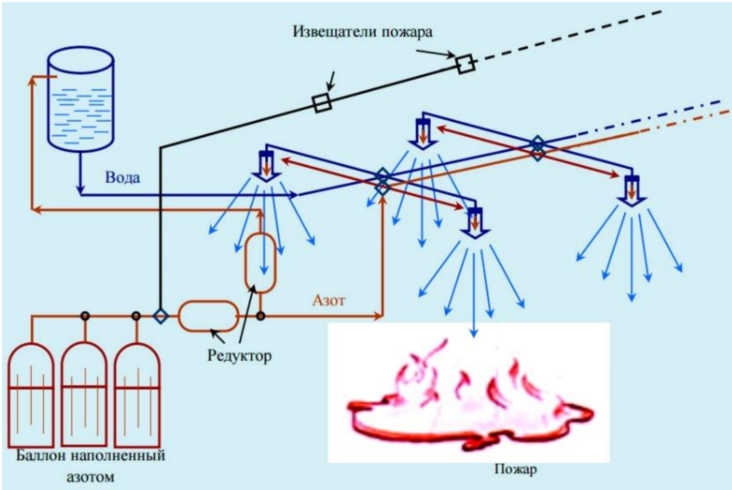


Fig. 11.5. Scheme of a special nitrogen-water fire extinguishing system

Each beam includes at least three detectors. By manually pressing the button of each of these detectors, the receiving station receives a signal indicating the number of the beam, i.e., the place of the fire. In the fire alarm system of the loop system, the detectors are connected in series to one common wire (loop), the beginning and the end of which are connected to the receiving station.

Automatic fire detectors, depending on the factor to which they react, can be thermal, smoke, light, ultrasonic and combined. According to the principle of action, they are divided into the maximum (triggered when the maximum permissible level of any factor is reached), differential (reacting to the rate of change of the parameter to which they are tuned) and maximum-differential (operating both at a certain rate of temperature rise and at critical air temperatures in the room).

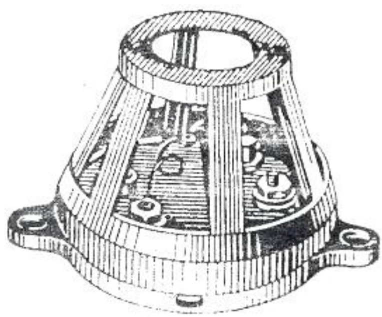


Fig. 11.6. DTL fire detector

It is necessary to regularly check the serviceability of the detectors of EPS systems. Thermal radiators are checked using a portable heat source (for example, a lamp with a power of at least 150 W with a reflector) at least once a year. The work of smoke and combined radiators is monitored, as a rule, once a month by means of portable sources of smoke and heat. Light detectors check the flame of a candle or a match.

Fig. 11.7. Temperature fire alarms of different brands

Deluge semi-automatic fire extinguishing systems

The deluge system is used to combat fires and prevent the spread of fire from one room to another in buildings of various purposes. This system is distinguished by the use of drenchers - irrigation heads of open type. Unlike sprinkler, the deluge fire extinguishing system does not have attachments with thermal locks that melt under the influence of temperature. Here, the delivery of the extinguishing agent is not performed after the fuse has melted, but on command from the sensors or manual control.

Fig. 11.8. Signaling part of automatic fire extinguishing device control

Since the deluge system involves the use of open irrigation heads, in some cases the pipelines remain in the standby mode dry, that is, unfilled. In this case, the extinguishing agent will be supplied to the outside only after the fire alarm is activated, and the pressure-boosting pumps turn on.

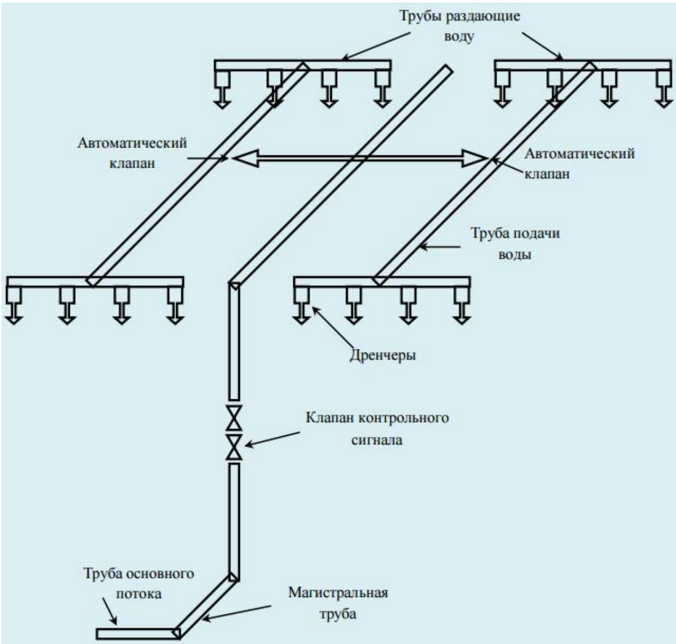


fig. 11.9. Semi-automatic deluge fire extinguishing system

Sprinkler fire extinguishing systems

Sprinkler fire extinguishing system is used in those cases when it is necessary to extinguish a small local fire in the room. This is an automatic system, that is, to activate its presence or control, a person is not required. Sprinkler fire extinguishing system is designed in such a way that at the initial stage of the fire, sprinklers with a low-melting nozzle are triggered, and a fire extinguishing agent is sent to the source of the fire.

The installation of sprinkler fire extinguishing systems involves the use of pipelines that are filled with water. Since ordinary firewater is used as the fire extinguishing compound, this fire extinguishing system can only be installed in rooms with a temperature above zero degrees.

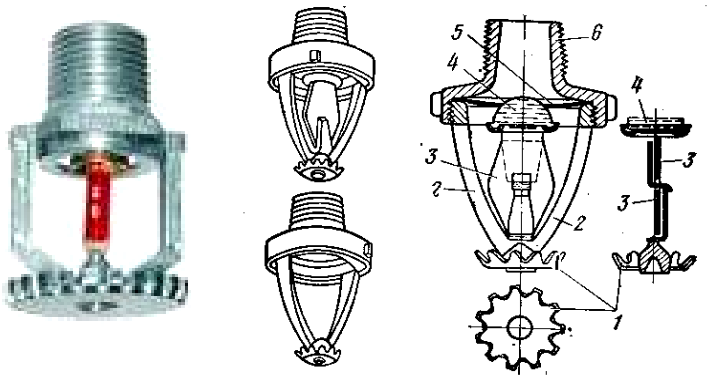


Fig. 11.10. Sprinkler: 1-socket, 2-ring ring. 3-lock, 4-hemispheric glass valve, 5-diaphragm, 6-body.

Light and daisy-fire detectors

Light detectors (SI-1, AIP-M, DPID, etc.) are characterized by non-inertia and a large (up to 600 m2) control zone. The phenomenon of photoelectric effect is used in light detectors. The photocell installed in them reacts to the ultraviolet or infrared part of the flame spectrum. Thus, the automatic detector IO-1 reacts to infrared radiation with a wavelength of 0.3 * 10-6 ... 2 * 10-6m, converting it into electrical energy, which, when entering the receiving station, triggers an alarm signal.

The SI-1 light detector (Fig. 11.11, a) consists of a sensor-a photon counter, an electrical circuit and a signal relay. The photon counter has high sensitivity and is able to detect even small foci of flame (for example, burning a match) almost instantly. Despite the high sensitivity, this detector does not work from daylight passing through the window panes, as well as from electric lighting, since the ultraviolet rays are absorbed by the windows of windows and lamps. SI-1 operates on the principle of line of sight of fire. In the absence of direct visibility, a light from a fire reflected by an object in the room may be sufficient to trigger an alarm.

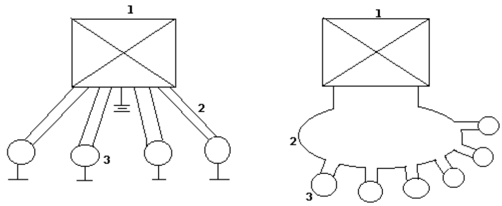
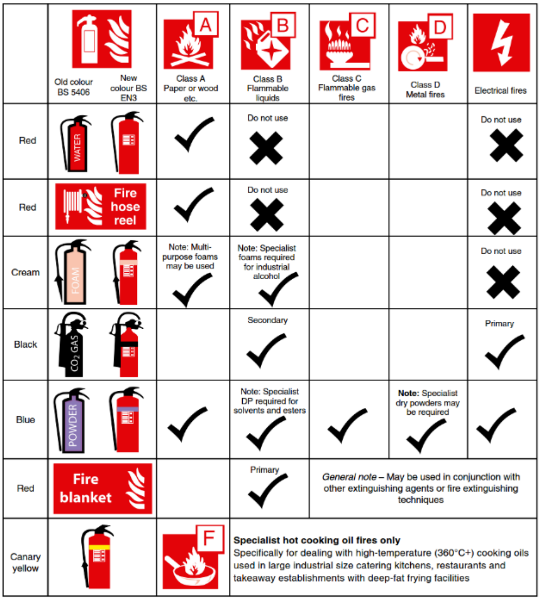


Fig. 11.12. System of fire light and fire detectors: 1-Reception station; 2-Line of rays; 3-Detectors; 4-Flex.



	Old colour BS 5406 / New colour BS EN3	Class A Paper or wood etc.	Class B Flammable liquids	Class C Flammable gas fires	Class D Metal fires	Electrical fires
Red	WATER	✓	Do not use ✗			Do not use ✗
Red	Fire hose reel	✓	Do not use ✗			Do not use ✗
Cream	FOAM	Note: Multi-purpose foams may be used ✓	Note: Specialist foams required for industrial alcohol ✓			Do not use ✗
Black	CO_2 GAS		Secondary ✓			Primary ✓
Blue	POWDER	✓	Note: Specialist DP required for solvents and esters ✓	✓	**Note:** Specialist dry powders may be required ✓	✓
Red	Fire blanket		Primary ✓	*General note* – May be used in conjunction with other extinguishing agents or fire extinguishing techniques		
Canary yellow		F	**Specialist hot cooking oil fires only** Specifically for dealing with high-temperature (360°C+) cooking oils used in large industrial size catering kitchens, restaurants and takeaway establishments with deep-fat frying facilities			

Fig. 5.26. Types of fire signs and brands

THEME 12

SAFETY AND EMERGENCY SITUATIONS.

Plan:

1. The concept of emergency situations (ES). State system of protection of the population and territories (SSES) in case of emergency.

2. Natural ES, their characteristics.

3. Natural Emergencies in Central Asia and their characteristics.

4. Technogenic emergency situations, their characteristics.

5. Social emergencies. Protection of the population and objects from terrorism.

6. Environmental emergency situations, their characteristics.

Basic terms: *emergencies, man-caused, natural and environmental emergencies, floods, mudflows and* *avalanches, the state system of emergencies, local, local, republican and transboundary emergencies, epidemic, epizootic, epiphytotic emergencies.*

The concept of emergency situations (ES). The State System of Protection of the Population and Territory (SSES) for Emergency Situations The phrase "emergency situation" is used in everyday speech and in special literature. In the dictionary of the Russian language SI Ozhegov, the word "extraordinary" is interpreted as "exceptional, very large, superior to everything". Such situations are often found in the life of each person. But that event, which is perceived as extraordinary by an individual or a group of people, is not always so for the whole society or state.

The death of a person in a road traffic accident in the domestic sense is the result of an emergency situation that has arisen in some local space. Such events only in our country, unfortunately, there are several tens of thousands each year. About one thousand people die daily from various dangers in Uzbekistan. Of course, all these cases can not be considered extraordinary. Naturally, the problem arises of the scientific definition of emergencies as a special term. This issue is non-trivial, it is directly related to the effectiveness of preventive work and the elimination of the consequences of emergencies.

March 4, 1996 by the Decree of the President of the Republic of Uzbekistan, the Ministry for Emergency Situations of the Republic of Uzbekistan was established. Decree as the main tasks determined:

-development and implementation of state policy in the field of preventing emergencies, protecting the life and health of the population, material and cultural values, as well as eliminating consequences and reducing damage in the event of emergencies, peace and wartime, etc.

The decree entrusts the leadership on ensuring the protection of the population and national economic facilities for the Prime Minister of the Republic of Uzbekistan.

On 11 April 1996, in accordance with the Decree of the President of the Republic of Uzbekistan of 4 March 1996, the Cabinet of Ministers of the Republic of Uzbekistan adopted a resolution on the organization of activities of the Ministry of Emergency Situations of the Republic of Uzbekistan. The resolution approved the regulations on the Ministry of Emergency Situations (MES) of the Republic of Uzbekistan and its structure. In accordance with the Resolution of the Cabinet of Ministers of the Republic of Uzbekistan of April 11, 1996, No. 143, the Republican Center for the Training of Leaders in Civil Defense and Emergency Situations was transformed into the Civil Protection Institute for training, retraining and advanced training of leading cadres, military and civilian specialists in prevention and liquidation consequences of emergency situations.

THEME 13.
NATURAL DISASTERS, THEIR CHARACTERISTICS.

Extraordinary situations of a natural nature threaten the inhabitants of our planet since the beginning of civilization.

In general, every hundred thousandth inhabitant perished from natural disasters on earth, and for the last hundred years - 16 thousand annually. Natural catastrophes are terrible for their surprise: in a short period of time they devastate the territory, destroy houses, property, communications.

After one catastrophe, like an avalanche, others follow: hunger, infection, disease. All natural emergencies are subject to certain general laws. First, for each type of emergency, a certain spatial confinement is characteristic. Secondly, the more the intensity (power) of a dangerous natural phenomenon, the less often it happens. Thirdly, each natural disaster is preceded by some specific signs (precursors). Fourthly, for all the unexpectedness of this or that natural disaster, its manifestation can be predicted. Finally, fifthly, in many cases, passive and active protective measures against natural hazards can be envisaged.

Speaking about natural emergencies, it is necessary to emphasize the role of anthropogenic influence on their manifestation. Numerous facts are known of the imbalance in the natural environment as a result of the activities of mankind, leading to an increase in dangerous effects.
At present, the scale of the use of natural resources has increased significantly, as a result of which the features of the global environmental crisis have become tangible. Nature as it were, takes revenge on a person for the brutal invasion of her domain. This circumstance should be borne in mind when carrying out economic activities. Observance of natural balance is the most important preventive factor, the account of which will reduce the

number of natural emergencies. Between all natural disasters there is a mutual connection. The closest relationship is observed between earthquakes and tsunamis. Tropical cyclones almost always cause flooding. Earthquakes cause fires, gas explosions, dam breaks. Volcanic eruptions - poisoning pastures, the death of livestock, hunger.

A prerequisite for successful protection against natural disasters is the study of their causes and mechanisms. Knowing the essence of the processes, you can predict them, and a timely and accurate forecast of dangerous phenomena is the most important condition for effective protection. Protection from natural hazards can be active (construction of engineering structures, intervention in the mechanism of the phenomenon, mobilization of natural resources, reconstruction of natural objects, etc.) and passive (use of shelters). In most cases, active and passive methods are combined.

Geochemical emergency. Natural disasters associated with geological natural phenomena include earthquakes, volcanic eruptions, landslides, mudflows, snow avalanches, landslides, and precipitation of the earth's surface as a result of karst phenomena. EARTHQUAKE

Earthquakes are earthquakes and vibrations of the earth's surface, resulting from sudden displacements and ruptures in the earth's crust or upper part of the mantle and transmitted over long distances in the form of elastic vibrations.

Earthquakes occur in the form of tremors, which include foreshocks, the main push and aftershocks. The number of jerks and time intervals between them can be very different. The main impulse is characterized by the greatest force, its duration is usually a few seconds, but people are subjectively perceived as very long.

OPOLZNI

The landslide is a sliding displacement down the slope under the influence of the gravity forces of the ground masses, forming the slopes of hills, mountains, river, lake and sea terraces.

Landslides occur when the stability of the slope is disturbed. The strength of the cohesion of soils or rocks is at some point less than gravity, and the whole mass comes into motion. Landslides are not catastrophic processes in which people die, but the damage they do to the national economy is significant: houses are destroyed, communication tunnels, pipelines, telephone and electrical networks are damaged.

TSUNAMI

A tsunami is a dangerous natural phenomenon, representing sea waves that arise mainly as a result of shifting up or down the long sections of the seabed during underwater and coastal earthquakes.

Hydrometeorological emergency situations, the causes of their occurrence. Emergencies of a hydrometeorological nature can be caused by the following reasons:

• Wind, including storms, hurricanes, tornadoes (at a speed of 25 m / s and more, for the Arctic and Far Eastern seas - 30 m / s and more);

• heavy rain (with a rainfall of 50 mm or more for 12 hours or more, and in mountain, mudflow and rainfalls areas - 30 mm or more in 12 hours);

• large hail (with a diameter of grades of 20 mm and more);

• heavy snowfall (with the amount of precipitation 20 mm and more in 12 hours);

• strong snowstorms (wind speed 15 m / s and more);

• dust storms;

• frosts (when the temperature of the air in the growing season decreases on the surface of the soil below 0 ° C);

• strong frosts or intense heat.

HURRICANE

The hurricane is a wind of great destructive force and considerable duration, the speed of which is approximately 32 m / s and more (12 points on the Beaufort scale).

FLOOD

Flooding is a significant flooding of water in the terrain as a result of rising water levels in a river, lake or sea, caused by various causes. It often causes material damage, damages the health of the population and leads to the death of people.

SQUALL

Short-term wind gains to speeds of 20-30 m / s are called squalls.

STORM

A storm is a wind, whose speed is less than the speed of a hurricane, but it is quite large and reaches 15-20 m / s. Losses and destruction from storms are significantly less than from hurricanes. A strong storm is sometimes called a storm.

COUNTRY

The flow with a very high concentration of mineral particles, rocks and rock fragments (up to 50-60% of the flow volume), which suddenly arises in the basins of small mountain rivers and is caused, as a rule, by rainfall or rapid melting of snows.

TORNADO

A whirlwind is an atmospheric vortex that appears in a thundercloud and then spreads in the form of a dark sleeve or trunk towards the surface of the land or sea.

AVALANCHE

Avalanche is the sudden movement of a mass of snow, ice, rocks down the mountain slopes, which poses a threat to human life and health. Avalanches account for approximately 50% of accidents in the mountains. The condition for the formation of avalanches is a mountain snow-covered slope with a steepness of 15 to 30 °, a strong snowfall with an increase in intensity of 3-5 cm / h. The most avalanche periods of the year are winter in the spring - at this time up to 95% of avalanches are recorded. The avalanche can go away at any time of the day, most often in the daytime - 68%, at night - 22% or in the evening - 10%.

Biological emergency situations, measures to prevent

Biological emergency includes epidemics, epizootics and epiphytoty.
The epidemic is the widespread spread of infectious disease among people, far exceeding the incidence rate usually registered in a given area.
A pandemic is an unusually high incidence of both the level and extent of spreading to a number of countries, whole continents and even the entire globe.

Among many epidemiological classifications, a widely used classification is based on the mechanism of transmission of the pathogen.
In addition, all infectious diseases are divided into four groups:

- intestinal infections;
- respiratory tract infections (aerosol);
- blood (transmissible);
- infections of the outer layers (contact).

The basis of the general biological classification of infectious diseases is their division primarily in accordance with the characteristics of the causative agent reservoir - anthroponosis, zoonosis, and the division of infectious diseases into vector-borne and non-transmissible diseases.

Infectious diseases are classified according to the type of pathogen - viral diseases, rickettsiosis, bacterial infections, protozoal diseases, helminthiases, tropical fungal infections, diseases of the blood system. Epizootic - animal infectious diseases - a group of diseases that have such common signs as the presence of a specific pathogen, the cyclicity of development, the ability to transmit from an infected animal to a healthy one, and take epizootic spreading.

Epizootic focus - the location of the source of the causative agent of the infection in a certain area of the terrain, where in this situation it is possible to transmit the causative agent to susceptible animals. An epizootic focus can be facilities and areas with animals there who have been diagnosed with the infection. In the breadth of the spread, the epizootic process occurs in three forms: sporadic incidence, epizootic, panzootic.

All pathological changes in plants are manifested in a variety of forms and are divided into rot, mummification, wilting, necrosis, plaque, outgrowth.

THEME 14.
PROTECTION MEASURES AND PROCEDURE OF ACTION WHEN PREVENTING A NATURAL CHARACTER

In case of warning about the threat of an earthquake or the appearance of its signs, it is necessary to act quickly, but calmly, confidently and without panic.

In advance warning of the threat of an earthquake, before leaving the apartment (house), it is necessary to turn off the heating appliances and gas, if the furnace is heated, to extinguish it; then you need to dress children, old people and get dressed yourself, take the necessary things, a small supply of food, medicine, documents and go outside. On the street should be as soon as possible to move away from buildings and structures in the direction of squares, squares, wide streets, sports grounds, unfinished plots, strictly observing the established public order.

If an earthquake has started unexpectedly, when it is not possible to get together and leave the apartment (home), it is necessary to take a place (get up) in the door or window aperture; As soon as the first tremors of the earthquake abate, you should quickly go out into the street.

At enterprises and institutions during an earthquake, all work stops, production and process equipment stops, measures are taken to cut off the current, reduce the pressure of air, oxygen, steam, water, gas, etc.

Workers and employees in civil defense formations are immediately sent to the areas of their collection, the remaining workers and employees occupy safe places. If the production, the furnace, the process line, the turbine and the like can not be stopped or impossible in the short term due to production conditions, then they are transferred to a sparing mode of operation. In mountainous areas, after heavy snowfalls, the danger of snow avalanches increases. About this the population will be notified by various warning signals, installed in the places of possible avalanches and possible snow falls.

Do not neglect these warnings, you must strictly follow all recommendations. If your area often suffers from floods, study and remember the boundaries of possible flooding, as well as elevated, rarely flooded places located in close proximity to places of residence, the shortest routes to them. Familiarize family members with the rules of conduct for organized and individual evacuation, as well as in the case of sudden and rapidly developing floods. Remember the places of storage of boats, rafts and building materials for their manufacture. Prepare in advance a list of documents, property and medicines exported during evacuation.

Put in the special suitcase or rucksack valuables, necessary warm clothes, a stock of food, water and medicines.

How to act during a flood. On the basis of the warning of the threat of flooding and evacuation, without delay, in the established order, leave (leave) from the danger zone of possible catastrophic flooding to the designated safe area or to elevated areas of the terrain, taking with them documents, valuables, necessary things and a two-day supply of non-perishable foodstuffs. At the final point of evacuation, register.

Before leaving the house, turn off electricity and gas, extinguish the fire in the heating stoves, fix all the floating objects that are outside the buildings, or place them in the back rooms. If time allows, valuable household things move to the upper floors or to the attic of a residential house. Close the windows and doors, if necessary and time, hammer outside the windows (doors) of the window and the doors of the first floors. In the absence of an organized evacuation, before the arrival of relief or a drop in water, you are on the upper floors and roofs of buildings, on trees or other towering objects. At the same time, always give a distress signal: in the daytime - by hanging or waving a well-visible cloth lined to the shaft, and in the dark - by a light signal and periodically by voice. When rescuers approach calmly, without panic and fuss, with precautionary measures, go to the swimming facility. At the same time, strictly observe the requirements of rescuers, do not overload the boats. While driving, do not leave the set places, do not board, strictly comply with the requirements of the crew. It is recommended to get out of the flooded area independently only if there are such serious reasons as the need to provide medical care to the victims, the continuing rise in water level with the threat of flooding of the upper floors (attic).

It is necessary to have a reliable swimming device and know the direction of movement. In the course of self-nomination, do not stop giving a distress signal.

Provide help to people swimming in the water and drowning.

If a hurricane (storm, tornado) caught you in the building, move away from the windows and take a safe place at the walls of the interior, in the corridor, near the built-in closets, in the bathrooms, toilet, pantries, in sturdy cupboards, under tables. Extinguish the fire in the stoves, turn off the electricity, close the taps on the gas networks.

In the dark, use lanterns, lamps, candles; turn on the radio for obtaining information about the management of civil defense and emergency situations and the commission for emergency situations; if possible, are in a sheltered shelter, in shelters, cellars, etc. If a hurricane, a storm or a tornado caught you on the streets of a settlement, keep as far as possible from light structures, buildings, bridges, overpasses, power lines, masts, trees, rivers, lakes and industrial facilities. To protect against flying debris and shards of glass, use sheets of plywood, cardboard and plastic boxes, boards and other improvised means. Try to hide faster in cellars, cellars and radiation shelters in settlements.

Do not go into damaged buildings, as they can collapse with new gusts of wind. When snow storms take shelter in buildings. If you are in a field or on a country road, go out to the main roads, which are periodically cleared and where there is a high probability of helping you. With a dusty storm, cover your face with a gauze bandage, a handkerchief, a piece of cloth, and your eyes with glasses.

When a signal is received about the approach of a tornado, it is necessary immediately to descend into the shelter, the cellar of the house or the cellar, or to hide under the bed and other solid furniture. If a tornado finds you in an open area, take cover at the bottom of a road ditch, in pits, moats, narrow ravines, pressing tightly to the ground, covering your head with clothes or tree branches. Do not stay in the car, get out of it and take cover, as indicated above.

Protection from hail in a safe hiding place (house, apartment, carport, cave, car). Shelter of animals and birds in special rooms. Shelter of cars in garages or under the crown of trees. Warn the accident is always easier than fix it. Prevention is carried out in three main directions: elimination of the source of infection, exclusion of ways of transmission of the pathogen of infection, increased immunity of people and animals (immunization).

Elimination of the source of infection includes:

1) disinfection - destruction of the pathogen in the objects of the external environment, in the premises, in the territories, on clothes, clothes, skin;

2) pest control - destruction in the environment of harmful insects;

3) deratization - the destruction of rodents.

When a foci of infection occurs in a contaminated area, quarantine or observation is introduced. Observation is introduced when infectious agents are identified that are not particularly dangerous, and in areas directly in contact with the quarantine zone. Quarantine - complete isolation of the source of infection from the public (the environment). Around the center of the infection, as a rule, security is established, entry or exit is prohibited, as well as the removal of property.

Forecast information is received by the Emergency Situations Monitoring and Forecasting Service of the Central Emergency Situations Ministry, where the drafts of specific decisions for management are summarized and developed. Based on these data, management identifies specific measures to prevent and eliminate emergencies. At the beginning of this year, the Resolution of the President of the Republic of Uzbekistan on measures to prevent emergencies related to flood, mudflow, avalanche and landslide phenomena and elimination of their consequences. This decree defines the main tasks and is divided into ministries and departments. The government commission on ensuring safe passage of flood waters and mudflows, reducing threats of snow and avalanche and landslide phenomena was approved. The commission is headed by the prime minister, the commission includes ministers and hokims of the regions. In the event of emergencies of the Republican level, a governmental commission comprising interested ministries and agencies shall carry out an analysis of socioeconomic and environmental impacts and losses.

The results of the analysis in the form of recommendations are forwarded to the interested agencies for implementation. There is a state system for centralizing the population of the Republic to the districts, through sirens, loudspeakers, television and radio programs, as well as local warning systems in hazardous facilities. The Ministry of Emergency Situations coordinates and controls the preparation of the population for the basics of life safety. The Ministry of Emergency Situations regularly conducts special exercises and trainings on the readiness of the population to reduce disasters of emergency situations.

Projects under the program for protection from emergencies at the community level (neighborhood, kishlak, village) are also carried out by the Red Crescent Society (planting seedlings on a landslide dangerous slopes). Cleaning of drainage systems to reduce groundwater, cleaning river beds, canals, sais to ensure the passage of flood mudflows. We must admit that no single state, and in most cases, and the whole region as a whole, does not have the resources sufficient to reduce environmental threats, including for the prevention and liquidation of natural and man-made emergencies that are hanging over the state or the region.

In connection with the transboundary and transnational nature of these problems, they should be addressed at the regional level. Those. it is necessary to organize permanent emergency response teams, establish closer ties between the services of states, develop cooperation and partnership relations with developed countries, and deepen cooperation within the region itself. In this regard, the importance of implementing a unified policy in the field of eliminating the consequences of emergencies in the region is growing. In this connection, in the Republic of Uzbekistan there is a lot of work to develop and implement the state policy on forecasting, prevention and actions in emergency situations. The formation in the republic of a perfect system of prevention and adequate response to emergencies is conducted on the basis of rich international experience, the achievements of modern science and technology and is regarded as one of the strategic components of national security.

Technogenic ES, their characteristics.

Man-made emergencies are associated with human production activities and can proceed with pollution and without pollution of the environment.

Environmental pollution can occur in accidents in industrial plants with the release of radioactive, chemically hazardous and biologically hazardous substances.

Accidents involving the release or threat of release of radioactive substances include accidents occurring at nuclear power plants, nuclear installations of research centers, nuclear vessels and the fall of aircraft with nuclear power plants on board, as well as at nuclear weapons complex enterprises. As a result of such accidents, strong radioactive contamination of the terrain or water area may occur.

Accidents with emission (threat of release) of chemically hazardous substances occur at chemical facilities in the country, at bases and temporary storage depots of chemical warfare agents (BHC) and cause chemical contamination of territories outside their sanitary protection zones, and damage to personnel and the public.

Accidents with the release (threat of release) of biologically hazardous substances include accidents that entailed the contamination of large areas with biologically hazardous substances when released by industrial enterprises and research institutions that develop, manufacture, process and transport bacterial products. Emergencies of anthropogenic nature are diverse both for reasons of their occurrence and for scale. By the nature of the phenomena, they can be divided into 6.

The causes of man-caused emergencies All the reasons that cause emergencies of anthropogenic nature can be divided into three groups:

- technical - imperfection, dilapidation of structures;
- natural - specific meteorological, hydrological or tectonic conditions, natural emergencies, accidents (for example, one of the causes of airliner accidents is the entry of birds into the engine of the aircraft);
- Anthropogenic ("human factor") - non-compliance with safety rules, errors, negligence, negligence.

Often the causes of man-made disaster are a combination of a number of factors, for example, before the Chernobyl accident a combination of technical and anthropogenic causes resulted.

The causes of the emergence of man-made emergencies: failure to comply with safety rules and negligence, design imperfection, criminal elements and terrorism, military actions, natural phenomena.

Protection of the population from technological emergencies

Protection against natural disasters can be active (construction of dams against floods, bombardment of lava flows, strengthening of slopes against landslides) or passive (evacuation, use of shelters).

The main measure of protection against earthquakes is evacuation of the population and observance of instructions. The same is true for volcanic eruptions. Various protection measures are used in the fight against landslides: registration of lands subject to landslide phenomena, strengthening of slopes, shelling of avalanche areas, etc. Also successfully we can withstand floods, constructing dams, artificial reservoirs, regulating the channel. Somewhat worse is the situation with sea floods, when there is no time for evacuation, and storm surges can flood vast areas. Tropical cyclone warnings are given in time, but protection from them is difficult. At the sites in advance, special measures are being developed to prevent or minimize the consequences of natural disasters. Such measures include strict adherence to specific security measures, organization of alerting of command personnel, formations and the population, special training and equipping of formations, rendering medical assistance to injured and material assistance to the victims, etc. Major industrial accidents and catastrophes cause great damage to the national economy, therefore ensuring trouble-free work is of extremely great national importance.

Measures to prevent accidents and disasters are the most complex and time-consuming. They represent a complex of organizational and engineering-technical measures aimed at identifying and eliminating the causes of accidents and catastrophes, minimizing the possible destruction and loss in the event that these reasons are not completely eliminated, and creating favorable conditions for organizing and conducting rescue and urgent emergency recovery works.

Social emergencies. Protection of the population and objects from terrorism.

Social danger is a danger that has become widespread in society and threatens the life and health of people. Bearers of social. Dangers are themselves people. An emergency of a social nature is a situation in a certain territory, formed as a result of a dangerous social phenomenon that resulted in human casualties, damage to health, property or the environment. Social catastrophe is an abrupt change in the society that arises as a sudden response of the social system to smooth changes in external conditions with tragic consequences.

Terms of distribution Social dangers and disasters: there must be a source of danger, an object of danger. **Classification of emergency social.**

Character:

-The nature of origin is divided into psychological (blackmail, extortion), physical (armed conflicts, terrorism), chemical-biological, suicide.

- In scale, they are divided into local, regional, national and global

- Organization: casual and intentional

- According to the age: children's, women's, youth's and general.

Social disasters always tend to move to a global scale. Emergencies that can not be prevented are called inevitable: natural disasters, a pandemic. Preventable emergencies are mainly socio-political.

Risk Factors in Emergencies:

- The accumulative factor - the signs that accumulate over time (for example, outrage in the social system in the USSR).

- Initial - acts instantly on a large territory and on a large number of people. For example - the result of inflation. For the main category of citizens, the price factor plays a significant role.

- Sequence of how the emergencies of a social nature occur. Either slightly in time or long. The presence of such an emergency near the hearth can be fatal. The further we are, the better we can filter out the information. The more opinions, the more choices we have.

When approaching the risk zone, individuality is lost. If we are outside the ES - we are indifferent, to understand the person who is near the hearth is difficult. Unemployment is typical for the Saratov region. To prevent ES, a large number of programs to combat unemployment, in theory it should work, in practice (in the example of the 90s), as a result of unemployment, a social and economic crisis arose. Always emergency situations of this kind will carry consequences in the form of a crisis of the state level. The state depends on the society. Many technical and humanitarian specialties are not in demand.

At the moment, there is no adequate response to changes in demand and supply. In order to ensure the normal operation of the state, there are normative acts, in particular the concept of national security. It has changed several times, and now there is not a concept, but strategic planning for national security until 2020. It clearly specifies internal and external threats. The first place is considered political security, then economic.

Despite the clear division of responsibilities between the structures, there are no applications at the household level.

The only moment that affects people is the safety of education, science and technology. There are painted models of scientific and educational activities, but it is unclear who will be responsible for the failure to fulfill duties in this area. Protection of the population against terrorism In all states of the world, authorities are struggling with mass riots. Depending on the strength of the performance, the intensity of the situation, the number of participants use different methods of restraint of unrest. Sometimes it is enough to announce that the rally is not authorized and ask all those present to disperse. But it is often impossible to cope with peaceful means, then force is used. How can we behave in such circumstances? Do not join the protesters "for the sake of interest." Find out first if the meeting is authorized, for which the speakers are campaigning. Do not enter into a non-officially registered organization, this can entail criminal penalties. During the riots, try not to get into the crowd, both the rally participants and the spectators. Special forces will not disassemble who is right and who is to blame, and a guilty gibber can get the head on a head. Take ID documents with you.

Means of combating panic are diverse.

- Persuasion (if time permits);
- categorical order;
- information about the insignificance of the danger or the use of force and even the elimination of the most vicious panic. Stopping the crowd, which panics, is much easier, starting from the edges, reducing the group as much as possible.

When approaching the street crowd:

- should quickly go into the side streets and lanes; - You can go to the nearest entrance, ask for shelter from his tenants or go up to the attic or the roof of the house and wait out the riots there;
- you can get on the peak of the capital structure, another steady elevation, or through the dormer window,

climb into the basement, hide under a nearby trolleybus, a heavy car, etc .;

- You can not run away from the crowd in the direction of its movement and into unknown alleys, as this, firstly, can provoke a chase, secondly, lead to a dead end where the crowd will overtake you, thirdly, you can be between the crowd and forces rule of law and suffer from both. In the moving crowd:

- it is necessary to avoid places of contact of the crowd with buildings, especially with storefronts, barriers, drainpipes; - should "swim" in one direction, trying to stay on their feet;

- It is recommended to remove scarves, ties, chains, glasses, tighten belts, belts, tie the laces tightly;

- You can not try to resist the movement of the crowd, to approach stationary objects, especially to grasp for them;

- in no case can you bend down, straighten your shoes, pick up lost things - this can lead to a fall, which in the crowd is tantamount to death. If you fall in the crowd, try to rise faster. Try to stand on the soles or on the socks, and then, sharply pushing away from the ground, rise up. If you can not stand up, curl up; protect the head with forearms, and the back of the head with the palms.

In order to prevent explosions of apartment buildings, it is necessary:

- to install in the attics and cellars solid doors, hang locks on them, place intercoms, check all the empty premises in the house;

- to inspect and, if possible, remove the cars standing in the courtyard of the house;

- To get acquainted with the tenants who rent apartments in your house, inform suspicious persons about the suspect;

- pay attention to strangers, address them with questions;

- to be afraid of parcels and letters, where your name is wrongly written, without a return address or with an unknown return address, parcels with a shifted center of gravity, letters in unusually thick (more than 3 mm), heavy envelopes that resemble rubber.

To prevent explosions in the street:

- During periods of social tension, one should avoid visits to crowded places (markets, stadiums, stations, entertainment events);

- It is not recommended to approach suspicious objects left in public places, immediately report them to the police or the National Security Service;

- Do not raise it yourself and teach children not to pick up small things found on the street - whistles, pens, cigarette cases, toys, etc., as very often terrorists hide bombs in them;

- categorically you can not independently clear explosive devices or transfer them to another place.

Rules of conduct for hostages:

- should stay in its place, trying not to attract attention, it is better to take something by yourself;

- You can not engage with the terrorists in wrangling, ask questions or look them in the eye;

- it is recommended to fulfill all their requirements, not to create conflict situations;

- If necessary, go to the toilet, open the bag, etc., you should ask for permission;

- when expressing a request to release children, women, elderly people, do not be intrusive and overly persistent;

- try to remember how many terrorists, who are the main ... - believe that you will be saved.

The course of the operation to neutralize terrorists:

- with the beginning of the assault, the capture group should lie on the floor and remain in this position until the end of the operation; - In case of tear gas application, eyes should not be rubbed, you need to breathe through a wet handkerchief, quickly and often blink, causing tears;

- leave the facility only after the corresponding team of rescuers; - On the street you should carry out the commands of the members of the capture group, you can not run, so as not to perish in a shootout.

Psychological aspects of emergency situations

As a rule, every emergency situation is associated with a danger to human life and health. This naturally causes him feelings of fear, confusion, often determines inadequate behavior. Emotional reactions arising in connection with fears for their lives and those around them are the result of the influence of strong stimuli inevitably appearing in all natural disasters, catastrophes and major accidents. These reactions are exacerbated by the fact that emergencies arise suddenly, often at night, they are accompanied by disruptions in the operation of electricity and water supply systems, and in case of natural disasters - and a sharp deterioration in meteorological conditions. Heavy natural disasters and disasters are a difficult test for many people. A person's mental reaction to extreme conditions, especially in cases of significant material loss and loss of life, can permanently deprive a person of the ability to rational actions and actions. However, it should be noted that in any, even the most difficult conditions, 12-15% of people retain self-control, correctly assess the situation, clearly and resolutely act in accordance with the situation. This is determined by the level of their psychological defense, which is formed in everyday conditions.

There are two forms of a person's reaction to an emergency situation - passive and active. The sense of danger in some people turns into a feeling of doom, makes a person completely helpless, confused and incapable of purposeful actions, including active protection. In other people, the threatening situation is capable of causing a general upsurge of spiritual and physical strength, encouraging them to perform their tasks more persistently, more accurately and quickly, without knowing fatigue. Some people instinct of self-preservation pushes to escape from threatening circumstances and environmental factors, and others, on the contrary, mobilizes to active response actions.

Assessing the traumatic effect of certain adverse factors that arise in life-threatening situations on the mental activity of a person, one should distinguish between psycho-emotional (normal) reactions of people to an extreme situation and pathological conditions. For the first, the psychological clarity of the reaction, its direct dependence on the situation and, as a rule, a short duration are typical. With such reactions, working capacity remains (although it decreases), the possibility of contact with others and a critical assessment of their behavior. In the literature such reactions are designated as a state of stress, mental tension, etc.

Psychopathological same disorders are painful conditions, almost completely disabling people and requiring special care.

Ecological character.

A natural and technogenic catastrophe is called the destructive process, which develops as a result of the disturbance of the normal interaction of technological objects with the components of the surrounding natural environment, leading to the death of people, destruction and damage to the objects of the economy and components of the natural environment.

The term "ecological disaster" (ecological catastrophe) is often used, it is an extraordinary event of a particularly large scale caused by changes in the state of land, atmosphere, hydrosphere and the biosphere and adversely affecting the health of people, habitat, economy or gene pool. In a number of cases, an ecological catastrophe is the result of dangerous natural phenomena. For example, in 1980 there was an eruption of the St. Helena volcano (USA), which resulted in the destruction of coniferous forests on an area of several tens of thousands of hectares.

The ES group of an environmental nature includes events related to the change in different environments:

1. Emergencies related to changes in the state of land (soil, subsoil, landscape):

- catastrophic subsidence, landslides, landslides of the earth's surface due to the development of mineral resources during the extraction of minerals and other human activities;

- the presence of heavy metals (including radionuclides) and other harmful substances in the soil (soil) above the maximum permissible concentrations;

- intensive soil degradation, desertification over vast areas due to erosion, salinization, waterlogging of soils, etc.;

- crisis situations associated with the depletion of non-renewable natural resources;

- critical situations caused by overfilling of storage facilities (landfills) with industrial and domestic wastes, pollution of their environment.

2. Emergencies related to changes in the composition and properties of the atmosphere (air):

- sudden changes in weather or climate as a result of anthropogenic activities;

- exceeding the maximum permissible concentrations of harmful impurities in the atmosphere;

- temperature inversions over cities;

- "oxygen" hunger in the cities;

- significant excess of the maximum permissible level of urban noise;

- the formation of a vast zone of acid precipitation; destruction of the ozone layer of the atmosphere;

- change in the transparency of the atmosphere.

3. Emergencies related to the change in the state of the hydrosphere (aquatic environment):

- a sharp shortage of drinking water due to the depletion of water sources or their pollution;

- Depletion of water resources necessary for the organization of domestic water supply and maintenance of technological processes;

- violation of economic activities and ecological balance due to pollution of the zones of inland seas and the oceans.

4. Emergencies related to changes in the state of the biosphere:

- disappearance of species of animals, plants, sensitive to changes in environmental conditions;

- loss of vegetation over a vast territory;

- a sharp change in the ability of the biosphere to reproduce renewable resources.

Change in the composition of the atmosphere.

The change in the composition of the atmosphere leads to an impact on the radiation regime of the atmosphere - this is the main mechanism of anthropogenic influence on the global climate system at the current and expected level of industrial development in the coming decades.

The contribution of greenhouse gases to the atmosphere (see the greenhouse effect) constitutes the main part of this impact. The influence of the concentration of greenhouse gases on temperature is determined by the absorption of long-wave radiation from the earth, and, consequently, by the decrease in the effective radiation at the earth's surface.

In this case, the limiting temperatures increase, and the temperature of the higher layers of the atmosphere decreases due to large radiation losses. This effect is strengthened by two circumstances:

1) the increase in the amount of water vapor in the atmosphere with warming, also overlapping long-wave radiation;

2) polar retreat of ice during warming, it decreases the albedo in relatively high latitudes.

All long-lived greenhouse gases and ozone give positive radiation exposure (2,9 ± 0,3 W / m2). Total radiation exposure human factors associated with the concentration of greenhouse gases and aerosols, is 1.6 (0.6 to 2.4) W / m2. All types of aerosols create a radiation effect of direct action and oppose

The total aerosol exposure is negative (-1.3 ± 0.8 W / m2). However, the reliability of these estimates is much lower than those obtained for greenhouse gases (Evaluation report, 2008).

Greenhouse gases in the atmosphere, which are significantly affected by economic activities:

- Carbon dioxide (CO_2) is the most important for the impact on the climate of greenhouse gas. Over the past 250 years, an unprecedented increase in its concentration in the atmosphere by 35% has been observed. In 2005, it amounted to 379 million-1;

- Methane (CH_4) is the second most important greenhouse gas after CO_2; its concentration increased 2.5 times as compared to the pre-industrial period and amounted to 1774 billion-1 in 2005;

- nitrous oxide (N_2O), its concentration increased by 18% by 2005 compared to the pre-industrial period and amounted to 319 billion-1; At present, approximately 40% of the amount of N_2O entering the atmosphere is due to economic activity (fertilizers, livestock, chemical industry).

According to the IPCC Fourth Assessment Report (2007), during the industrial era, there is a significant increase in atmospheric concentrations of climatically active gases. Thus, during the last 250 years, the atmospheric concentrations of carbon dioxide (CO_2)

have increased from 280 to 379 ppm (millionths per unit volume). The current concentration of greenhouse data in the atmosphere, as follows from the analysis of air bubbles from glacial cores, which preserved the composition of the ancient atmosphere of Antarctica, is much higher than ever in the last 10 thousand years. The global atmospheric concentration of methane increased from 715 to 1774 ppb (billions per unit volume) during the industrial era.

The strongest growth in the concentration of greenhouse gases has been observed in recent decades, as a result of which the atmosphere is heated. Thus, the process of modern climate warming occurs against the backdrop of a steady increase in the concentration of greenhouse gases, and primarily of carbon dioxide (CO2). So, according to the data for 1999, CO2 emissions as a result of human activity, from the burning of fossil fuels, reached 6.2 billion tons in 1996, which is almost 4 times more than in 1950. From 1750 to 2000 there was an increase in the concentration of carbon dioxide in the atmosphere by 31% (Perevedentsev, 2009).

Change in the state of the hydrosphere The human impact on the natural environment is continuous. Man increasingly affects the environment and climate. Every minute industrial enterprises, power plants, motor vehicles burn huge amounts of fuel, which leads to a continuous increase in the content of carbon dioxide in the atmosphere. And this can lead to serious global consequences. Scientists believe that this process causes warming due to the so-called greenhouse effect.

In addition, chemically active impurities enter the atmosphere: freons, fluoride, bromide and chlorine changes, which destroy the ozone layer and affect the thermal regime of the planet. A harmful influence on the climate is provided by tests of nuclear weapons that promote the formation and accumulation in the atmosphere of aerosol, nitrogen oxides, radiocarbon and other components that destroy the ozone layer and disrupt the thermal balance of the atmosphere.

Pollution of the atmosphere is the entry into the air of pollutants (aerosols, gases, particulate matter) in quantities and concentrations that alter the composition and properties of significant amounts of air masses and have a negative impact on living organisms. Sources of natural air pollution are: cosmic dust, volcanic activity, wind erosion of soils, weathering of rocks. Great pollution of the atmosphere from economic activities. The main pollutants: nitrogen oxides, sulfur, carbon, gaseous compounds, dust, aerosols.

In recent decades, atmospheric pollution has rarely increased in large cities and industrial centers due to the increasing amount of emissions, which today amounts to about 400 kg per person per year. Increased air pollution by vehicle exhaust gases. Dust is growing. Over industrial centers or large cities, a contaminated layer of air is formed, the so-called smog, which can be conditionally divided into three tiers: the lower one, lying between the houses, connected with the emission of exhaust gases by transport and raised dust; The second, smoke-fed heating systems, is located above the houses at an altitude of about 20-30m; The third one at an altitude of 50-100 m, is fed mainly by industrial enterprises.

It must also be taken into account that when solar radiation is exposed to a mixture of hydrocarbon gases and nitrogen oxides emitted into the atmosphere with exhaust gases, photomicrographs are formed, which poses a great danger to human health. High level of noise. With the development of technical progress, the noise level in cities is constantly increasing and an increasing part of the population is exposed to its destructive effect almost all day and night.

The introduction of new technological processes, the growth of equipment capacities, the mechanization of production and other processes, the emergence of powerful means of land, air and water transport have led to the fact that a person is constantly exposed to noise of high levels. This contributes to the emergence and development of neurological, cardiovascular and other diseases.

In the general noise fund of the city, the share of transport is from 60 to 80%. Intraquarter noise sources: sports games, games at playgrounds, loading and unloading at stores is 10-20%. The noise regime in residential apartments is composed of noise that penetrates from outside and is formed as a result of the operation of engineering and sanitary equipment.

THEME -15

FIRST MEDICAL AID AT BLEEDING, CLOSED DAMAGE, FRACTURES, WALLS, RECOVERY, SOLAR THERMAL IMPACT, BURNS, BLOODS, POISONING.

Plan:

1. First aid for bleeding.
2. First aid for closed injuries.
3. First aid for fractures.
4. First aid for wounds.
5. First medical aid for drowning.
6. First aid for a solar heat stroke.
7. The first medical aid for burns, frostbite.
8. First aid for poisoning.

Basic terms: *nature, society, environment, natural factors, ecology and politics, natural resources, renewable and non-renewable resources, modern* *technology and technology, urbanization, anthropogenic impact, scientific and technological progress, human ecology, material well-being, ecological decline, noosphere, adaptation, a healthy population of mankind, rotation of biological substances.*

When bleeding There are arterial, venous and capillary bleeding. Blood from the gaping wound pours out light red color rhythmically, pulsating jet with arterial bleeding, and dark color continuous continuous stream - with venous. Capillary bleeding - blood from damaged small vessels flows out like a sponge. When providing first aid, temporary bleeding is used. Methods of temporary stop bleeding

Stop arterial bleeding should always begin with finger pressure artery. For this, a pulsation of the artery is felt, which is pressed against the bone with a finger for a short time, necessary for applying a pressure bandage, a tourniquet or a twist. Bleeding from a wound localized in the area of the shoulder girdle, shoulder and forearm is stopped by pressing the subclavian artery to the 1st rib in the supraclavicular area, and the brachial artery to the humerus along the inner edge of the biceps muscle. With arterial bleeding from the wounds of the lower extremity, the femoral artery in the inguinal fold to the pubic bone should be squeezed.

An elevated limb position, a tamponade of the wound and a tight pressure bandage can help stop both prolunic and most arterial bleeding. The forced flexion of the limb with fixation in an excessively bent position is carried by the arterial vessel. This effect is enhanced by placing a tight cotton-gauze or any other object on the lower joint or knee joint and then firmly fixing the limb in an excessively bent position with the help of a trouser belt.

To stop bleeding from the subclavian area and the upper half of the shoulder, the shaft is inserted into the axillary regions. Hands bent at the elbow joints are led behind the back and tightly fixed one to the other. The application of a twist (tourniquet) is applied only when simple and safe methods can not stop bleeding, and is used more often with bleeding from an amputated stump. When applying a twist (tow), the following rules must be observed:

1) to give the limb an elevated position;

2) apply a tourniquet above the wound and as close as possible to it;

3) the tourniquet is applied to clothing or a pad (kerchief, scarf, towel);

4) with the help of one or two rounds to stop bleeding;

5) the attached tow is securely fixed;

6) it is inadmissible to find a tourniquet on the limbs for more than 2 hours in summer and 1 hour in winter;

7) it should be noted in a prominent place (the forehead of the victim) the date and time of application of the harness;

8) in winter time, the limb with a superfluous bundle should be wrapped with clothing or a thick layer of cotton wool.

Victims with temporarily stopped bleeding should be urgently delivered to the surgical hospital in a horizontal position on a shield or stretcher.

With closed faults

Closed faults include:

1) bruises;

2) damage to ligaments and tendons;

3) dislocations.

Contusions - closed injuries of soft tissues without disrupting the integrity of the skin that occurs when a blunt object strikes, when falling on a hard surface. First aid for traumatic bruises. In order to prevent hemorrhage, it is necessary to hold the cold at the site of the injury, provide the injured body with absolute peace and apply a pressure bandage. With bruises of the head, chest, abdomen, accompanied by severe pain and worsening of the general condition, the injured person should be urgently shown to the doctor. Stretching or damage to the ligamentous apparatus of the joint occurs with sudden impulsive movements in the joint, which considerably exceed the limits of the usual mobility in it, or may be the result of a direct stroke on the strained tendon. The most common injuries are ligaments of the ankle, interphalangeal, wrist and knee joints, while the smoothness of the contours of the joint, the restriction of function and pain in the projection of damaged ligaments are determined. First aid:

1) application of cold on the joint area;

2) to make the immobilization of the joint a fixing 8-shaped dressing;

3) give pain medication;

4) send to a trauma center.

The tendons of the extensors of the fingers of the hand, the quadriceps muscle of the thigh and the heel (Achilles) tendon are most often damaged. The first aid consists in the immobilization of the limb by improvised means in a position ensuring the convergence of the ends of the tendon.

Dislocation is the displacement of the articulated ends of bones with damage to the joint capsule and the ligamentous apparatus of the joint. When the dislocation appears, acute pain, deformity of the joint, limiting active and passive movements and the forced position of the limb.

Dislocation in large joints can be accompanied by significant damage to soft tissues, blood vessels and nerve trunks, which determines the urgent direction of the victim in the hospital. First aid in case of dislocation includes: applying cold, giving the elevated position of the injured limb, immobilizing the damaged joint with improvised means, the need to deliver the injured person to a trauma center.

With fractures

Fracture (violation of the integrity of the bone) can be closed and open (with damage to the skin). With a fracture, acute local pain is noted, which is strengthened when the limb moves and loads axially, swelling and an increase in the circumference of the limb segment at the fracture level. Absolute signs of fracture: deformation of the damaged segment and pathological bone mobility. The first aid consists in the transport immobilization of the limb, most often using tires from improvised materials (boards, plywood strips, etc.).

Correctly executed transport immobilization prevents an increase in the displacement of bone fragments and reduces the soreness in the transport of the victim, and hence the possibility of developing traumatic shock, especially with a hip fracture. In the absence of funds for splinting, the upper limb can be suspended on a kerchief or fixed to the trunk, the lower one - pribintovat to a healthy limb. When providing first aid to patients with open fractures, it is necessary to lubricate the skin around the wound with an alcohol solution of iodine.

When the fracture is open, it is absolutely unacceptable to push the bone to the depth of the wound or cover it with soft tissues, since infectious agents can infiltrate into deep tissues along with them. On the bone fragments protruding from the wound, several sterile wipes should be applied.

With an open fracture of the limb with heavy bleeding, it is necessary to apply a hemostatic tourniquet (twist) above the fracture, which is applied before immobilization. To stop bleeding, apply a pressure bandage on the wound area.

To fix the limb and deliver the victim to a specialized hospital. When providing first aid, one should not seek correction of the existing deformity of the limb.

General principles of immobilization in fractures. For fractures of long tubular bones, a minimum of two joints adjacent to the injured segment of the limb must be recorded. It is often necessary to fix three joints. Immobilization will be reliable in the event that the fixation of all joints functioning under the influence of the muscles of this segment of the limb is achieved.

Thus, with a fracture of the humerus, the shoulder, elbow, and wrist joints are fixed; at fracture of the bones of the lower leg, it is necessary to fix the knee, ankle and all the joints of the foot and fingers. The finiteness should be fixed in the average physiological position, in which flexor muscles and extensor muscles are relaxed to the same degree.

During tire application, care should be taken when handling the damaged limb to avoid further injury. It is desirable to impose a tire with an assistant, which holds the limb in the desired position.

With wounds Wounds can be very diverse depending on their origin, the degree of tissue damage, microbial contamination, location, depth. Wounds can differ in the nature of the wounding weapon or object: cut, chopped wounds, chipped - the deepest and most dangerous; bruised wounds, bitten wounds - are dangerous for the possibility of occurrence of rabies. At deep wounds not only the skin with subcutaneous fat is damaged, but also muscles, bones, nerves, tendons, ligaments, and sometimes large blood vessels. There may be penetrating wounds, accompanied by damage to the internal organs. When injuries, bleeding, pain and, almost always, a gap, ie, a divergence of the edges of the wound, necessarily occur.

It should be remembered that all wounds are infected. In the first hours after the injury, the microbes are mostly still on the surface of such a fresh wound and in the static state, that is, they do not yet multiply and show their morbid properties. This should be taken into account when providing first aid.

First aid in case of injury is to protect the wounds from secondary contamination. Surrounding the skin around the wound should be twice lubricated with an alcohol solution of iodine and apply a sterile bandage, avoiding touching the wound itself. Foreign bodies, embedded in the tissue, should not be removed, as this may increase bleeding. Any washing of the wound is prohibited!

1. With scalped wounds, the flap often breaks off to the side, subcutaneous by the tissue to the outside. In this case, it is necessary to raise the flap urgently and to coat the dermal surface with an alcohol solution of iodine. If the wound bleeds profusely, the help begins with a temporary stop of bleeding - the application of a pressure bandage to the wound, and with severe bleeding - the application of a tourniquet. In severe wounds of limbs, transport immobilization is necessary.

The victim must necessarily seek medical help from a doctor. Patients with any wound must necessarily enter tetanus antitetanus and toxoid.

2. With bitten wounds inflicted by any animal, the victim, after first aid, immediately goes to the emergency room, where the issue of the presence or absence of indications for preventive rabies vaccination is being decided.

3. In poisoned wounds (snake bites) it follows: squeeze the first drops of blood from the wound; suck off the poison with the mouth for 15-20 minutes (safely

under the condition of a healthy oral mucosa and frequent spitting of saliva); grease the place of bite with a solution of iodine or diamond; apply a bandage; to immobilize the limb; give the victim plenty of drink; to deliver the victim to the nearest medical institution. It is forbidden: to put a tourniquet on the affected limb; cauterize the bite site;

produce cuts on the skin in order to remove the poison.

When drowning Drowning - the filling of the airways with a liquid (usually water) or liquid masses (mud, mud), causing an acute disruption of breathing and cardiac activity.

Drowning can lead to fatigue when swimming for long distances, trauma - a bruise on stones or hard objects when diving, as well as alcohol intoxication. An unconscious condition can occur when a sudden change in temperature occurs when immersed in water; after overheating in the sun; when blood is redistributed due to overfilling of the stomach with food; with muscular strain; from fear during an accidental fall into the water.

The nature of rendering assistance to the victim depends on the severity of his condition. If the victim is conscious, he needs to be reassured, take off his wet clothes, wipe dry his skin, change clothes; if consciousness is absent, but the pulse and breathing are retained, the victim should be allowed to inhale ammonia, to release the thorax from the restraining clothes; To activate breathing, you can use the rhythmic twitching of the tongue.

In the absence of cardiac activity and breathing, the simplest methods of revitalizing the body are used. First of all, it is necessary to remove fluid from the respiratory tract. To this end, the caretaker puts the victim's belly on his bent knee, the victim's head hangs down and water can flow from the upper respiratory tract and stomach. After the removal of water immediately proceed to artificial respiration, after a quick cleansing of the mouth cavity affected by sand, silt, vomit.

The most effective methods are the artificial respiration of the mouth in the mouth and mouth in the nose. When carrying out artificial respiration, the victim is in a supine position on the back with a sharply thrown head. This position of the head contributes to the fullest opening of the entrance to the larynx.

Breathing the mouth in the mouth and mouth in the nose is best done through gauze or other thin tissue. During the injection of air into the mouth, the nose is clamped, the mouth of the victim should be closed while blowing into the nose, and the lower jaw is pushed forward. Simultaneously with artificial respiration, external heart massage is performed, producing 3-4 strokes after each inhalation (injection). Attempts to revitalize a drowned swing on a sheet, blanket, etc. (pumping out) are meaningless and should not take place. In any condition of the victim, measures are taken to warm the body by rubbing, massaging the upper and lower extremities.

All this is done immediately after the drowning out of the water (ashore, in a boat, on a raft) before the arrival of the doctor or delivery of the victim to the hospital, where he will be provided with qualified medical care.

With a solar heat stroke Thermal shock is a painful condition that occurs as a result of a general overheating of the body with prolonged exposure to high ambient temperature. Thermal shock occurs because overheating and excessive sweating the body loses a large amount of fluid, the blood thickens, the balance of salts in the body is disturbed.

In severe conditions, this leads to oxygen starvation of tissues, in particular the brain. Sunstroke occurs when exposed to direct sunlight on the uncovered head. Usually, the body overheats and the central nervous system is mainly affected. The first signs of a sunstroke:

1) listlessness;

2) weakness;

3) nausea;

4) headache;

5) dizziness;

6) darkening of the eyes;

7) the face turns red;

8) there is sometimes a slight increase in body temperature.

With further overheating, the body temperature rises to 38-40 ° C, vomiting occurs, fainting may occur, and sometimes even convulsions. In severe cases, excitement, hallucinations, delirium, seizures like epileptic seizures, loss of consciousness, coma are observed. Pulse, respiration, blood pressure decrease. Before the arrival of the doctor, the injured person should be placed in a shade or in a well-ventilated area. To the head, as well as to the area of large vessels (lateral surfaces of the neck, armpits, inguinal areas) apply bubbles with ice or cold water. The victim is wrapped in a wet sheet, blowing cold air, as evaporation of water from it will somewhat reduce the temperature. To the bow they bring cotton wool with ammonia. Thirst is quenched with cold water, tea, coffee. When breathing is stopped, artificial respiration is performed. With an average and severe degree of sunstroke, the victim must be taken to a medical facility to provide medical assistance.

To avoid heat or sunstroke, you must follow the rules of being in the sun, the correct drinking regime. With burns, frostbite First aid for thermal burns. Care must be taken to remove the smoldering clothes from the victim. You can not detach the remains of clothes from the burnt surface, they need to be cut with scissors along the border of the burn and apply a bandage directly to them. Burns of the 1st degree are treated with 70% alcohol. For burns of grade II, apply a dry sterile dressing to the burnt surface after treatment with alcohol, and apply a sterile bandage at grade III - IV.

With extensive burns of any degree, the victim should be wrapped in a clean sheet, carefully wrapped in blankets and delivered as quickly as possible to a medical institution. When providing first aid, it is forbidden to open the blisters, apply any lotions, rinses, ointment dressings. For the prevention of shock apply rest, warming and pain medications, plentiful drink in the form of a soda-salt solution (1 teaspoon of table salt and 1/2 tsp of baking soda for 1 liter of water). When transporting the burned, if possible, they are laid on an undamaged area of the body and carefully wrapped and as much as possible given a warm drink.

At burns of respiratory tracts from inhaled hot air (in case of fire) or smoke, labored breathing, hoarseness of voice, cough. It is urgent to send the victim to the hospital regardless of the severity of the skin burn. Chemical burns are most often caused by contact with the skin or mucous membranes of various chemicals: strong acids, alkalis, volatile oils, phosphorus, as well as from prolonged exposure to fumes of gasoline or kerosene.

First aid: immediate and copious washing within 5-10 minutes of the affected area with water, preferably under pressure. When burns with lime or phosphorus, you must first remove the residues of the substance dryly and only after that start washing.

Affected area is washed with neutralizing solutions: with burns with acids or phosphorus - 2% solution of bicarbonate soda or soapy water, with burns with alkalis 1-2% solution of citric, acetic or boric acid. Then apply a dry bandage, and with burns phosphorus make a lotion from 2-5% solution of copper sulfate or 5% solution of potassium permanganate. When burns with phosphorus, oil dressings should not be used. The victim with any kind of frostbite is placed in a warm room. The patient is given hot tea, coffee, wine. The burned part of the body is rubbed with cleanly washed, moistened or greased with sterile petroleum jelly hands, and preferably with alcohol or vodka until the frosted place turns red and becomes warm.

Do not rub the snow, as it cools the skin. Dirty and sharp ice can damage and contaminate frostbitten skin. At the end of grinding, the frosted area should be dried, wiped with alcohol and put a clean bandage on it with a thick layer of cotton wool. Do not lubricate the frostbitten body with iodine tincture or any fat, as this complicates the subsequent treatment. If there is already swelling or bubbles, then rubbing can not be done. When poisoning

Poisoning with household chemicals. After getting into the body of a strong acid or alkali, it is urgent to call an ambulance. Immediately remove saliva and mucus from the mouth. With signs of suffocation, carry out artificial respiration of the mouth in the nose. When vomiting, rinse the stomach is strictly prohibited, since acid or alkali can get into the respiratory tract. This procedure can be performed only by a health professional. The victim is given a drink of 2-3 glasses of water. In no case should you try to neutralize toxic fluids. This leads to the formation of carbon dioxide, stretching the stomach, increasing pain and bleeding. With the development of suffocation, the victim is urgently sent by any transport to a medical institution. When poisoning with household chemicals (without acid or alkali) before the doctor arrives, you should call the patient to vomit (if he is conscious). Patients in the unconscious state should be laid so that the head is lowered and turned to the side so that the contents of the stomach do not get into the respiratory ways. With tongue twisting, cramps, when the jaws are tightly closed, gently toss up the head and push the lower jaw forward and upward to ensure breathing through the nose.

When poisoning with sleeping pills or soothing drugs (sedatives), the victim should be laid, lifting his head. Rinse the stomach with 1-2 liters of water, induce vomiting, pressing on the root of the tongue. Then give a drink of strong tea, eat 100 grams of black breadcrumbs. Do not give milk. It accelerates the receipt of the poison that caused the poisoning into the intestine and prevents its excretion from the body. The patient in the unconscious position is strictly forbidden to wash the stomach.

Water can get into the respiratory tract and lead to death from suffocation. If the victim does not breathe or his breathing is suppressed, artificial respiration should be performed. When alcohol poisoning, the victim needs to inhale vapors of ammonia, give 3-4 glasses of water (with 1 tsp of baking soda to a glass), induce vomiting, drink strong tea or coffee. When poisoning with methyl alcohol or ethylene glycol, it is necessary to drink 100-150 ml of ethyl alcohol (vodka) if the victim consciousness, since it is an antidote, slows the breakdown of methyl alcohol. When poisoning with mushrooms, immediately deliver the patient to the hospital. Before the doctor arrives, rinse the stomach with a soda solution or potassium permanganate solution, and the intestines - using laxatives (castor oil, bitter salt), to make an enema. The patient is allowed to drink salted water. When poisoning with inhalation chlorophos or carbophos the patient is taken to the air, remove contaminated clothing, and wash the open areas of the body with water.

If the pesticide is swallowed, the stomach is washed 4-5 times: give 3-4 glasses of salted water to drink and induce vomiting. Then take a laxative - 1 tbsp. l. bitter salt. It is very good to take 5-6 tablets of besalol or bicarbon.

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