Ministry of Health of Ukraine
Ukrainian Medical Stomatological Academy

APPROVED
at a meeting of the department
disaster medicine
and military medicine
«____» _____ 2020
protocol № 2 from 28.08.2020

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Methodical instructions
for independent work of students
during preparation for a practical (seminar) lesson
and in class

Academic discipline	**Training of reserve officers**
Module № 1	Pre medical care in extreme situations
Topic of the lesson	Domestic care under the influence of mass destruction
Course	2
Faculty	foreign students training specialty "Medicine", "Stomatology"

Poltava-2020

1. TOPIC 10. MEANS OF MASS DESTRUCTION. HOME CARE

2. Relevance of the topic:

Military action in the modern war will be conducted with high activity and extreme tension. They will cause great losses in the troops and among the population, the destruction of potentially dangerous objects, energy centers, hydraulic structures, the formation of large areas of destruction, fires and floods. The main form of counteraction in the war is armed struggle - the organized use of armed forces and means of destruction to achieve certain political and military goals, a set of military actions of various scales. including high-precision, ammunition of volume detonation, cluster and incendiary. The most effective are high-precision systems of conventional weapons, which provide automatic detection and reliable destruction of enemy targets and objects with a single shot (launch). The main types of high-precision ammunition include guided missiles of various classes and planned aerial bombs, have a circular, probable deviation from the target is not more than 10 m.

Specific goals:

• be able to provide home care in case of defeat by strong poisonous substances

• be able to provide home care for radiation injuries;

• be able to use medical protection for chemical injuries be able to use medical protection for radiation injuries.

Competences and learning outcomes, the formation of which is facilitated by the discipline (the relationship with the normative content of training of higher education, formulated in terms of learning outcomes in the Standard).

According to the requirements of the standard, the discipline provides students with the acquisition of competencies:

-integral: The ability to solve typical and complex specialized problems and practical problems in professional activities in the field of health care, or in the learning process, which involves research and / or innovation and is characterized by complexity and uncertainty of conditions and requirements. The ability of the individual to organize an integrated humanitarian educational space, the formation of a single image of culture or a holistic picture of the world.

-general: The ability to apply knowledge in practical situations. Ability to exercise self-regulation, lead a healthy lifestyle, ability to adapt and act in a new situation. Ability to choose a communication strategy; ability to work in a team; interpersonal skills. Ability to abstract thinking, analysis and synthesis, the ability to learn and be modernly trained. Definiteness and perseverance in terms of tasks and responsibilities.

-special (professional, subject): Ability to carry out medical and evacuation measures. Ability to determine the tactics of emergency medical care. Emergency care skills. Skills to perform medical manipulations.

Basic knowledge, skills, abilities necessary for studying the topic (interdisciplinary integration):

Names of previous disciplines	Acquired skills
1. Human anatomy	Anatomy of the head and neck, anatomy of the chest, abdomen, pelvis and limbs. Anatomy of the vascular system.
2. Normal physiology	Physiological bases of respiratory system functioning.

Tasks for independent work in preparation for class and in class:
Students should know:
- medical and sanitary consequences of the accident at HNO and RNO;
- possible types of lesions in case of accident on HNO and RNO;
- clinical manifestations of potent toxic substances;
- signs of radiation sickness;
- principles of application of radioprotectors.

The list of the basic terms, parameters, characteristics which the student should master at preparation for employment:

Term	Definition
Chemically dangerous object	facility where manufactured, used as raw material, stored or transported highly toxic substances; in the event of an accident and destruction of which mass damage to people, animals and plants can occur.
Accidents at chemically hazardous facilities	violation of the technological process of production, which leads to the release into the environment of toxic substances that can cause damage to humans, animals and plants.
Toxic substance (toxin)	should be considered a chemical compound of inorganic or organic origin, which as its action (unity of quantity and quality) under certain conditions causes poisoning with its specific symptom complex.
	these are liquids with a faint mustard odor, stable (from one day to several weeks), enter the human

	body in any way.
Toxic substances of skin resorptive action	colorless liquids, with the smell of hay or rotten apples, under normal conditions go into a vaporous state. Stability on the ground for 15-30 minutes. The steam is 3.5 times heavier than air. Respiratory organs are affected.
Toxic substances of suffocating action	colorless crystalline substances. Cause irritation of mucous membranes at a concentration of 0.005 mg / liter.
Toxic substances of irritating action	is called the release of radioactive substances outside the nuclear power reactor, which may create an increased radiation hazard, which is a threat to human life and health.
Radiation accident	this is the flux of α, β, γ, neutron radiation. α and β-particles have a short path length and do not affect ionization.
Penetrating radiation (ionizing radiation)	such a dose of ionizing radiation, which in 1 cm3 of dry air at a temperature of 0 ° C and a pressure of 760 mm Hg forms 2.08 billion ion pairs.
X-ray	it is the absorbed dose of irradiation, which is equal to the energy of one joule absorbed by one kilogram of biological substance. 1 Gray = 100 rad.
Gray	acute polysyndromic disease that develops after a single, repeated or prolonged for several hours or days of external irradiation, internal irradiation of the whole organism, with mixed irradiation of deep penetrating ionizing radiation at a dose of more than 1 Gy.
Acute radiation sickness	

Theoretical questions for the lesson:

1. Accidents at chemically dangerous objects.

2. Classification and characteristics of potent toxic substances. 3. Domestic care in case of defeat by strong poisonous substances.

4. Impressive factors of accidents at radiation-hazardous objects.

5. Radiation damage.

6. Radiation sickness, signs.

7. Radioprotectors.

8. Home care in combat and non-combat conditions.

Practical work (tasks) performed in class:

- carrying out emergency "iodine prophylaxis";

-use of means of individual medical protection (AI-1, AI-2, IPP-8, IPP-10, PPI) at radiation and chemical defeats.

TOPIC CONTENT:

CAUSES of accidents at chemically hazardous facilities are often: high level of depreciation of fixed assets (process equipment); imperfection of production technologies; negligence of industrial personnel in drainage operations; lack of modern process control systems and emergency protection. In addition, a chemical accident can occur as a result of a natural disaster (emergency of a natural nature).

Most hazardous chemicals pose a danger to humans both when inhaled (inhaled) and in contact with the skin. The main factors affecting human skin in accidents at chemically hazardous facilities: the impressive concentration of highly toxic substances in the air, the liquid phase of substances and thermal radiation in fires.

Chemically dangerous objects

Mass casualties can occur if an accidental release of a dangerous chemical forms a center of chemical damage, which poses a danger to workers and employees of the production site (on the national economy), for the population of residential neighborhoods (in the city) and working villages or rural settlements. points (in the suburban area). The main striking factor here is the chemical contamination of the surface layer of the atmosphere. It is also possible to infect water sources, soil, vegetation, etc.

The center of chemical damage covers the area where the toxic product spilled, as well as the area of chemical contamination on the leeward side of the spill site (sources of infection). The size of the focus of chemical damage depends on the volume of spilled chemically hazardous substance, the nature of the spill (free, in a tray or embankment), weather conditions, toxicity of the substance and the degree of protection of people.

When emitting (duct) toxic substances, the area around chemically dangerous objects can be divided into three zones of chemical contamination according to the levels of striking factors, depending on the level of striking concentration of potent toxic substances, time of their exposure, fire flame).

Chemical contamination zone - an area or water area within which hazardous chemicals are distributed (or introduced) in concentrations and quantities that endanger human life and health, for farm animals and plants during a given time.

The first zone is the most dangerous due to the high concentration of potent toxic substances, the possibility of contact with the liquid phase (pouring) and the action of open flames. It can develop approximately 250 m from the source of infection.

The second zone is less dangerous: the concentration of potent toxic substances here is about 2-3 orders of magnitude less than the maximum possible, the influence of the liquid phase and fire is unlikely. This zone includes the area at a distance of 250-1000 m from the source of infection.

The third zone of chemical contamination usually has a concentration of potent toxic substances 4-5 orders of magnitude lower than possible. This area can be removed at a distance of 1000 m or more from the source of infection.

Particularly dangerous are accidents in which there is an uncontrolled release of toxic chemicals that occur as a result of an explosion, fire or breakdown of process equipment, transport tank or pipeline.

In such accidents, toxic products are released into the atmosphere in the form of gas, vapor or aerosol, forming a cloud of contaminated air, which can spread over long distances.

In this case, the depth of the zone of spread of contaminated air depends on the concentration of hazardous chemicals and wind speed. Example,

- At a wind speed of 1 m / s the cloud in one hour will move away from the accident site to yards, dead ends, basements and creates an increased danger for the population.5-7 km,

-At a speed of 2 m / s - 10-14, and at 3 m / s - 16-21 km. A significant increase in wind speed (6 - 7 m / s and more) contributes to the rapid dispersion of the cloud.

Rising soil and air temperatures accelerate the evaporation of hazardous chemicals and, consequently, increase its concentration over the infected area. The depth of distribution and the concentration of the toxic substance are significantly influenced by other weather conditions.

Potent toxic substances: concept and classification.

The impact of SDOR on the environment, population and personnel of the troops is possible in the destruction of the HNO due to emergencies, natural disasters, as well as during hostilities

Highly toxic substances (SDRs) are toxic chemical compounds that are formed in large quantities in the process of industrial production and are capable of entering the atmosphere in the event of destruction (accidents) at chemically hazardous facilities, causing massive damage to civilians and personnel and other power ministries and departments.

The current state of the world economy is characterized by a steady increase in chemical production.

According to the WHO, currently the number of toxic substances has exceeded 60 thousand chemical compounds and increases annually by 500-700 items. In addition, about 500 belong to the group of SDOR most toxic to humans.

Today in Ukraine there are more than 1,500 different facilities that produce, store or use more than 280,000 tons of various SDORs. These areas are home to 22 million people. The majority (up to 95%) of them are objects containing ammonia

and chlorine. In addition, about 15,000 units of rolling stock with dangerous goods are transported around the clock by the railways of Ukraine.

Despite the fact that the population of Ukraine is about 1% of the world's population, Ukraine processes up to 5% of total minerals, and the load of toxicants on the environment, as a result, is higher than in Western Europe 3.2 times and higher than in the US 6.2 times.

The product range of a chemical plant can include thousands of different materials and substances, most of which are extremely toxic. The danger of such plants for humans and the environment is obvious. A clear example of this is the accident at a chemical plant in Seveso (Italy, 1976). As a result of the accident, the area (more than 20 km2) was contaminated with dioxin, more than 1,000 people were injured (with a total population of 27.6 thousand people in the infected area).

The largest accident in the chemical industry in the history of the world was the catastrophe in Bhopal (India, 1984), which killed about 2,500 and killed more than 170,000 people. At the chemical plant of the American corporation Union Carbide, where there were five different productions, including methyl isocyanate and phosgene, which have high toxicity, 30 tons of methyl isocyanate were released into the environment. In the same year, an explosion of liquefied hydrocarbons in the San Juan Ixuatepec store (Mexico) killed at least 500 and killed nearly 7,200 people.

During 1985–2000, more than 204 accidents involving the release of industrial poisons took place in the territory of the former USSR. Every eighth of them is on the territory of Ukraine. As a result of accidents 1605 people were injured, poisoning 63 people (4%) were fatal. In 103 cases, the forces and means of the medical service of the Armed Forces were involved in the elimination of accidents.

In modern warfare in densely populated and industrialized regions, the enemy, even without the use of WMD, can create a mixed chemical situation by mass strikes of conventional, including high-precision ground, air and space weapons on numerous chemical plants and raw materials.

The impact of SDOR on the environment, population and personnel of the troops is possible during the destruction of the KhNO due to emergencies, natural disasters, as well as during hostilities.

A chemically hazardous object (CHO) is an object of the national economy where SDORs are produced or stored, in the event of an accident or destruction of which mass damage to people and animals, as well as damage to vegetation may occur. In peacetime, all of these facilities belong to potentially hazardous chemical industries, and in wartime, to additional sources of chemical hazards to troops and civilians. In total, there are more than 2,000 industrial facilities in Ukraine, which produce, store or use in production more than 300 thousand tons of SDOR, including about 10 thousand tons of chlorine and 180 thousand tons of ammonia.

Chemical and hazardous objects include:

- Chemical, oil refining, oil refining, pulp and paper, textile, metallurgical, etc. industries.
- Enterprises equipped with refrigeration units, water supply stations and water treatment plants using ammonia and chlorine, pipelines.
- Railway stations that have a moving train for sludge, which transports SDOR, vehicles.

• Warehouses and bases with a stock of substances for disinfection, disinsection and deratization of storages with grain and food.

• Warehouses and bases with stocks of pesticides used in agriculture.

• Research centers, terminals.

• Military chemical facilities (warehouses and landfills, chemical munitions destruction plants, special vehicles, missile fuel depots and facilities).

Chemical hazardous objects are characterized by a degree of chemical hazard. Thus, according to the number of population living in areas of possible chemical contamination, there are 4 degrees of chemical danger of the object:

• 1 degree of chemical danger - in areas of possible chemical contamination from each of them live more than 75 thousand people .;

• 2nd degree of chemical danger - in areas of possible chemical contamination from each of them live from 40 to 75 thousand people .;

• Grade 3 chemical hazard - less than 40,000 people live in areas of possible chemical contamination from each of them;

• Grade 4 chemical hazard - does not go beyond the site.

In total, about 22 million people live in areas of possible chemical contamination from these facilities.

There are a total of 40 HNOs in the city of Kyiv, 8 of which belong to the first degree of danger.

According to the number of SDORs stored at HNO, there are 3 degrees of chemical danger of the object - chlorine:

• And the degree of 250 tons or more.

• II degree 250-50 tons.

• III degree 50-0.8 tons.

To characterize HNO, where other SDOR are used, the coefficient of equivalence of the toxic substance to the first ton of chlorine is used:

• ammonia - 10,

• hydrogen sulfide - 10,

• nitrogen oxides, - 6,

• hydrocyanic acid - 2,

• phosgene - 0.75.

At the chemical enterprise, an average of 3–15 daily SDOR stocks are stored.

In addition, the degree of chemical hazard of the facility is determined by the toxicity indicators of SDOR, which are stored on HNO. According to this classification, there are 4 degrees of danger of HNO.

There are several ways to store SDOR:

• in tanks under high pressure (up to 100 atm.);

• in isothermal storage under pressure;

• in closed containers without pressure at ambient temperature.

With all methods of storage, the destruction of the container with SDOR and its release into the environment is possible.

When predicting the consequences of the accident, it is accepted that in peacetime it is possible to destroy one tank, and in wartime the simultaneous destruction of all tanks on the HNO.

In Ukraine, chlorine and ammonia are considered to be the most potentially dangerous SDORs.

Chlorine (Cl2) is a highly toxic substance, the reserves of which in the economy are particularly large. Thus, at a water treatment plant in a large city can be more than 10 tons of this substance. When such an object is destroyed, a focus of chemical damage is formed, where the number of poisoned people can exceed several thousand.

It is widely used due to its intense oxidizing action (bleach, disinsectant and disinfectant). Transported in liquid form.

Chemically hazardous facilities, which use and store large amounts of chlorine, chlorine-containing and other volatile toxic substances (liquid chlorine warehouses, water and sewage stations, chemical plants of the Ministry of Industrial Policy) are largely equipped with obsolete or worn-out equipment.

Accidents are most often associated with leaks in tanks or pipelines. Can be freely released during the reaction of obtaining chlorinated lime.

Ammonia (NH3) is used to produce nitric acid, an ammonia fertilizer, as a refrigerant in refrigeration plants.

In addition to rail, road and sea freight, ammonia is transported in significant quantities through pipelines, which could lead to accidental emissions.

The technical condition of refrigeration and compressor equipment, devices, shut-off and control equipment, power supply systems, control and measuring devices and automation at the vast majority (about 90%) of enterprises does not guarantee safe operation of ammonia refrigeration units.

The refrigeration pipes, through which ammonia flows from the engine rooms to the cooling chambers, contain from 0.5 to 6 tons of ammonia during operation. The rules of arrangement in refrigeration pipelines do not provide for their division into separate sections, which in case of damage to the route makes it impossible to stop the supply of ammonia and leads to its complete leakage.

About 40% of the inspected enterprises are annually refilled with liquid ammonia in quantities of 5 to 36 tons due to leakage of refrigeration systems. Systematic leakage of ammonia from these systems poses a risk of explosion in engine rooms and refrigerators, the supply and exhaust ventilation of which in 50% of cases does not fully meet regulatory requirements.

Almost every third enterprise violates the rules of storage and storage of liquid ammonia to one degree or another. The main shortcomings observed at these enterprises are the absence or damage of embankment around the tanks and receivers, the lack of spare tanks, the absence or malfunction of emergency pumps, the insecurity of tanks from lightning and direct sunlight.

In about 60% of enterprises that store ammonia in cylinders (usually small enterprises, consumer unions, individual shops and sections), cylinders are stored in unsuitable warehouses, and sometimes stored on the ground or in production facilities. The inspection found that in a large number of enterprises, installations for creating a water curtain around liquid ammonia tanks do not provide the primary localization of the ammonia cloud in the event of an accident with its release, and in some cases do not work at all.

In addition to chlorine and ammonia, such SDORs as ethylene chlorohydrin, 2,4-dinitrophenol, acrylonitrile, hydrogen sulfide, carbon disulfide, methyl bromide, ethylene oxide and dioxin are widely used in Ukraine.

It is necessary to dwell on dioxin separately. In Vietnam, the herbicide 2,4,5-T (trichlorophenoxyacetic acid) was used as a defoliant for military purposes, in which highly toxic dioxin (2,3,7,8-tetrachlorodibenzo-n-dioxin) was used as a by-product. Dioxin was not given proper toxicological significance at that time. Currently, a significant number of chemical technologies are known, in which dioxin is formed as a by-product: during chlorination of water, paper production, in addition, during the combustion of organochlorine compounds.

A big problem for Ukraine today is the low level of equipment of HNO systems for automated detection of highly toxic substances in the air. The availability of such systems is only 19%.

On average, 60% of enterprises are equipped with local warning systems, but in most of them they do not have sufficient supply of devices: automatic communication with local detection systems, meteorological devices, automatic information processing and signaling of contamination provided by the Ammonia Refrigeration Rules. other regulations.

Other shortcomings observed in the organization of the notification are the lack of direct communication with the civil defense headquarters and emergency situations of the appropriate level, law enforcement agencies, rescue units, poor quality of communication and its frequent failure due to technical reasons, low level of training of regular dispatchers for notification. It should be added that the working staff of the vast majority of enterprises are insufficiently informed about the alert signals and the actions after their submission.

On-site specialized formations have been established at almost all enterprises, but, as evidenced by the results of checking their readiness to act as intended, for almost 70% of enterprises they are not able to fully ensure the localization and initial elimination of the consequences of a possible accident , in connection with the reduction of staff, lack or obsolescence of the necessary equipment and property.

At the enterprises there is a problem of keeping storages in readiness for use. The main facts which are systematically revealed during checks are leak of storages, non-compliance of their arrangement with requirements of specifications, lack of means of control of structure of air, oxygen or air support, means of primary fire extinguishing, communication, availability of groundwater in storage facilities. Such shortcomings are observed at every second inspected enterprise. Due to the lack or obsolescence of regeneration cartridges, more than 80% of enterprises do not operate in air regeneration mode due to lack or obsolescence of regeneration cartridges.

Industrial gas masks of the KD brand, which provide protection against ammonia, the working staff of enterprises is provided on average by 80-90% (taking into account the inconsistency of the number of staff).

The variety of chemical compounds related to SDOR, and the significant difference between them in the way they act on humans, leads to the existence of several classifications of toxic substances used in industry.

According to the magnitude of the danger to the body of highly toxic substances are classified using different indicators.

Toxicity class	Major toxic substances	Maximum permissible concentrations in the air of the working area, mg / m3
substances are extremely toxic	3,4-benzpyrene, mercury, lead, ozone, phosgene	0,1
highly toxic	nitrogen oxides, benzene, iodine, manganese, copper, hydrogen sulfide, caustic alkalis, chlorine	0,1–1
moderately toxic	acetone, xylene, sulfur dioxide, methyl alcohol	1–10
slightly toxic	ammonia, gasoline, turpentine, ethyl alcohol, carbon monoxide	>10

Table 1.

According to the classification, which uses the indicator LD50, there are 6 classes of toxicity of highly toxic substances.

Toxicity class	LD50 (мг/л)
Extremely toxic	<1
Highly toxic	1-5
Highly toxic	6-20
Moderately toxic	21-80
Low toxicity	81-160
Practically non-toxic	>160

Table 2.

It should be borne in mind that even low-hazardous substances with prolonged action at high concentrations cause severe poisoning.

The structure and physicochemical properties of the group of highly toxic substances are heterogeneous. The biological effects of poisons are significant. Thus, they can be classified on the basis of the primary syndrome, which occurs in acute intoxication. Therefore, substances that can cause mass poisoning during the destruction of chemical objects are divided (according to the syndromic classification) into the following groups:

1. Substances with a dominant suffocating effect:

• a) with a pronounced cauterizing effect (chlorine, phosphorus oxychloride, phosphorus 3-chloride);

• b) with a weak cauterizing effect (phosphorus chloride, sulfur chloride, methyl isocyanate).

2. Substances with a dominant general toxic effect (dinitrophenol, ethylene chloride, ethylene fluoride).

3. Substances that have a suffocating and general toxic effect:

• a) with a pronounced cauterizing effect (acrylonitrile, nitric acid);

• b) with a weak cauterizing effect (sulfur dioxide, hydrogen sulfide, nitrogen oxides, hydrogen fluoride).

4. Substances that disrupt the generation, conduction and transmission of nerve impulses (carbon disulfide, organophosphorus compounds (FOS).

5. Substances that have a suffocating and neurotropic effect (ammonia).

6. Cytotoxic (metabolic) poisons (ethylene oxide, methyl bromide, dichloromethyl bromide, methyl chlorohydrin, ethane, dimethyl sulfate, dioxin, halogenated hydrocarbons).

Thus, the high potential threat posed by HNO and the toxicity of highly toxic substances require physicians to have a thorough knowledge of their toxicology, which will be discussed in the next question.

Home care for poisoning by potent toxic substances

Damage to industrial enterprises (storages, pipelines, etc.) during hostilities or natural disasters can cause personnel to be affected by highly toxic substances. While on or near such facilities, you should closely monitor your health and the symptoms that accompany the release of highly toxic substances into the atmosphere and pollution.

Ammonia

Colorless gas with an irritating odor. Small concentrations cause irritation of the mucous membranes of the eyes and upper respiratory tract. The victims experience nausea, headache, salivation, sneezing, flushing, sweating, chest pain, and urges to urinate. High concentration causes eye pain and severe tearing, suffocation, severe bouts of coughing, stomach pain, vomiting, urinary retention. After that, respiratory and circulatory disorders develop, death from heart failure and airway edema can occur.

Home care. Put on a gas mask, take the victim out of the affected area into the fresh air, use PPIs, breathe through a cotton gauze bandage moistened with 5% citric or acetic acid solution. In case of contact with ammonia, they should be rinsed well with water. To alleviate the pain, the victim is injected intramuscularly with a painkiller from a first-aid medical individual. In case of laryngeal spasms, mustard is applied and atropine is injected subcutaneously. When breathing stops, artificial respiration is performed and pacemakers and respirators are administered. The victim was immediately evacuated to a higher level of medical care.

Personal protective equipment: gas mask, all-military protective set.

Hydrogen sulfide

Colorless gas with the smell of rotten eggs. Poisoning occurs through the respiratory tract, to a lesser extent through the skin. Penetration of hydrogen sulfide into the blood is accompanied by a strong neuro-paralytic effect.

Home care. First of all, it is necessary to eliminate the effect of hydrogen sulfide, in case of respiratory disorders or shortness of breath - perform artificial respiration. In case of eye lesions, eye drops are used - 0.5% solution of dicaine. It is recommended to inhale chlorine (the handkerchief is soaked in a solution of chlorinated lime). In case of vascular insufficiency (pale gray color of lips and skin

on the face, weak pulse) enter adrenaline or caffeine. The victim was immediately evacuated to a higher level of medical care.

Personal protective equipment: gas mask, all-military protective set.

Chlorine

Extremely active chemically, combines directly with most chemical elements. The concentration of chlorine in water 0.001-0.006 mg / l leads to irritant action, the concentration of 0.1-0.2 mg / l at 30 minutes of action is life-threatening, the concentration of 0.5 mg / l at 15 minutes of action is lethal.

Damage and accidents at enterprises and storage facilities where chlorine is stored are the most dangerous for military personnel and civilians. At a concentration of 1 mg / l in the air, death occurs instantly.

Home care. Take the victim out into the fresh air, in case of severe damage, oxygen therapy is indicated, enter calcium chloride, glucose, drugs that stimulate respiration (etimizol, bimegrid). The victim was immediately evacuated to a higher level of medical care.

Personal protective equipment: gas mask, all-military protective set.

Nuclear weapons

Due to policy measures to contain the nuclear threat in the world, the likelihood of the use of nuclear weapons in modern military conflicts has decreased, but still continues to worry the progressive world society. In this context, emphasis should be placed on the medical protection of personnel from the damaging factors of the peaceful atom (accidents at nuclear power plants, enterprises engaged in the production, processing and utilization of nuclear fuel).

The striking factors of a nuclear explosion are: shock wave in the air (seismic waves in water, soil), light radiation, penetrating radiation, radiation contamination, electromagnetic pulse, mental action.

The shock wave, the main striking factor of a nuclear explosion, is a zone of strong air compression that propagates in all directions from the center of the explosion at high speed. A vacuum zone is formed behind the compression zone, which propagates in the opposite direction (to the center of the explosion) from the pressure zone. The shock wave leads to the destruction and damage of military equipment, buildings, as well as to mechanical injuries among personnel.

Clinical manifestations, depending on the severity of the lesion, are shown in table 3.

Table 3

Clinical manifestations depending on the severity of the lesion

Degree of defeat	Clinical manifestations
light	General mild contusion, temporary hearing impairment, bruising of various parts of the body, dislocations of the joints.
Average	Severe contusion, damage to the eardrums and internal organs, bleeding from the nose and ears, dislocations of the joints, bone fractures.
Severe	Severe contusion and significant damage to internal organs, bleeding from the nose and ears, dislocations of the joints, numerous fractures.

Extremely heavy	Severe injuries are usually incompatible with life.

Light radiation is a stream of radiant energy that propagates almost instantaneously and lasts up to 20 seconds, depending on the power of a nuclear explosion, and can cause skin burns, damage (permanent or temporary) to the visual organs, and ignition of combustible materials and objects.

There are three degrees of burns. First-degree burns (erythematous) are characterized by redness, swelling and pain; the second (bullous) - the formation of blisters with serous fluid; third (ulcerative-necrotic) - the death of the skin and the formation of ulcers. Shelters, fortifications, and shady objects are used to protect against light radiation.

There are three types of eye damage: temporary blindness (up to several minutes); burn of the bottom of the eye when looking directly at the explosion; burns of the cornea and eyelids.

Electromagnetic pulse - a short-term electromagnetic field that occurs during an explosion of nuclear munitions. The consequence of its action (tens to hundreds of km) can be burnout or breakdown of individual elements of electronic and electrical equipment. Defeat of people is possible only in cases when they are in contact with power lines at the time of the explosion.

Ionizing radiation is a stream of gamma rays and neutrons that lasts up to 20 s. Penetrating through living tissue, the latter ionize cell molecules, under the influence of ionization in the body there are biological processes that lead to disruption of vital functions of individual organs and the development of radiation sickness, and when a person is at the epicenter of an explosion (up to 4 kilometers depending on ammunition type and power) death comes.

Storage and radiation protection shelters are almost completely protected from the effects of ionizing radiation.

Radiation infection. As a result of the explosion, under the influence of neutron flux on the nuclei of atoms of molecules of substances in the external environment (soil), radioactive isotopes are formed, the decay of which produces alpha, beta and gamma radiation. A significant part of radioactive substances rises in ascending streams of hot air to a height of many kilometers, where together with the dust it forms a radioactive cloud. The largest particles of radioactive products of the explosion fall to the ground near the area of the explosion, others are carried by air currents and gradually settle to the ground, forming a zone of radioactive contamination, the length of which can reach several hundred kilometers. This infects the area, buildings, ponds, air, living things. The greatest danger of radioactive substances is in the first hours after the fall, as their activity in this period is highest.

There are three types of lesions that can lead to the development of radiation sickness:

- external irradiation;
- incorporation of radioactive substances;
- contact lesions of the body (with contamination of the body and clothing).

The radiation dose to unprotected personnel in the contaminated area depends on the level of radiation, the time spent in the infected area, the rate of decline of the radiation level.

In radiation accidents, the most dangerous are ionizing radiation and radiation contamination of the area - the causative factors in the development of radiation sickness.

Radiation sickness.

There are two forms of radiation sickness: acute and chronic.

Acute radiation sickness. Most often occurs in a relatively short period of time as a result of total external irradiation (gamma-ray radiation, neutrons) at a dose exceeding 1.0 Gy; characterized by a cyclic course (primary reaction, latent period, period of decay and recovery) and predominant damage to radiosensitive organs and tissues (hematopoietic tissue, intestinal epithelium, male gonads, etc.).

The period of the primary reaction begins depending on the radiation dose after a few minutes (at high doses) or a few hours (at lower doses). At first there is excitement, which is quickly replaced by a depressed state; develops general weakness, fatigue, headache, aversion to food, thirst, nausea, vomiting (sometimes repeatedly), abdominal pain. In severe cases, the manifestations of the primary reaction last up to 2-3 days, in mild - several hours.

The latent period is characterized by the absence of any complaints from the victim. In severe radiation sickness, its duration is very small (at high doses, radiation may be absent), in the case of moderate and mild forms of the disease lasts up to 2 weeks.

The period of disintegration is characterized by deterioration of the victim's condition, fever, diarrhea with blood and mucus, hemorrhage into the mucous membranes of the eyes, mouth, skin, nosebleeds, hair loss.

The period of decay of radiation sickness, depending on its severity, lasts up to 6 weeks. Death can occur due to a sharp suppression of hematopoiesis, the development of ulcerative necrotic changes, infectious diseases and others.

The recovery period can last up to several months and is characterized by a gradual recovery of combat and working capacity of the victims.

Chronic radiation sickness develops as a result of prolonged ionizing radiation in small (but much higher than permissible) doses, as well as as a result of the incorporation of radioactive substances that linger in the body for a long time.

Clinical manifestations: fatigue, irritability, shortness of breath, sweating, impaired sleep, memory, headache, diarrhea or constipation, muscle, bone pain, etc.

Radiation skin lesions

Contamination of the skin and uniforms with radioactive substances or prolonged contact with contaminated surfaces can lead to skin damage, mainly due to beta radiation.

There are four periods of radiation damage to the skin:

1. The period of early skin reaction to radiation. Depending on the dose, it occurs after a few hours or days and is characterized by the appearance of redness and swelling of the affected areas of the skin. The duration of the period is up to two days.

2. Hidden period. Redness and swelling disappear, the skin has a healthy appearance. The duration of the period depends on the radiation dose and can last up to 20 days.

3. The period of acute inflammation of the skin. Reddening (sometimes with a bluish tinge) of the affected areas of the skin occurs again, which is replaced by the appearance of blisters. After 2-5 days, the blisters merge; when they are injured, there are bleeding ulcers. Very often purulent processes develop. The duration of the period is several months.

4. Recovery period. Depending on the severity of the lesion can last about 1 year. The skin on the affected areas becomes thin, pale with dilated capillaries.

Home care.

Sanitary instructors are responsible for:

- organization of home medical care for the affected, taking into account their number, severity of the lesion, radiation situation;
- organization of partial sanitation;
- training of personnel in the skills of using individual means of protection, self-help and mutual assistance measures; shelter from the damaging factors of a nuclear explosion on the ground and in protective structures;
- control over the prevention of water and food consumption in contaminated areas;
- organization of evacuation of victims to the highest level of medical care.

Measures of pre-medical care in the center of a nuclear explosion (catastrophe) are provided in accordance with the identified symptoms of the victim and are aimed at eliminating or reducing the initial signs of radiation sickness. For this purpose, immediately after the explosion, the personnel on the commander's command wear personal protective equipment (gas masks, respirators, bandages, etc.) and skin.

In order to prevent the entry of radioactive substances into the body and skin lesions in the order of self- and mutual assistance (or by nurses or health instructors) is a partial sanitation. It is carried out both in the infected area and after leaving it, it is repeated before each meal (in the center of contamination - only with the permission of the commander).

Before processing it is necessary to remove (shake, sweep) radioactive substances from the front part of a gas mask and the personal weapon. Partial sanitation consists in washing hands, face and neck (and other exposed areas of the body) with uncontaminated soapy water, rinsing the eyes and rinsing the mouth with water from a flask, as well as shaking out uniforms and cleaning shoes.

In the center of ground-based nuclear explosions (accidents) it is necessary to ensure the fastest evacuation of the affected from areas of strong radioactive contamination.

Domestic care for victims evacuated from areas of radioactive contamination should be provided in areas with radiation levels that allow medical personnel to work without the risk of exposure. Places for first aid are determined by a chemist-dosimeter or a sanitary instructor-dosimeter. They also concentrate the victims who are waiting to be evacuated to a higher level of medical care.

Home care for combined lesions.

In the context of combat operations using weapons of mass destruction, a significant number of victims will have combined radiation or chemical damage with traumatic injuries.

Combined damage occurs as a result of the action of several types of weapons or damaging factors of one type of weapon, can be simultaneous or sequential.

Peculiarities of combined lesions are caused by the syndrome of mutual burden and are determined by the nature of the combined injury (radiation dose, type and dose of toxic substance - on the one hand, localization and severity of traumatic injury - on the other).

An essential feature of radiation damage is the relatively low percentage of emergencies in the first hours. For some time (depending on the type of nuclear weapon and the nature of the radiation), the symptoms of non-radiation injuries (pain, traumatic or burn shock, bleeding) dominate. Mutual burden syndrome is manifested by a severe general condition of the victim, slow healing of wounds and burns, reduced protective functions of the body and, as a result, the development of infectious diseases. When irradiated with significant doses or increased individual sensitivity, the symptoms of radiation sickness may prevail.

At defeat by the chemical weapon (especially organophosphorus substances) the victim at once needs urgent home medical care. In contrast to radiation injuries, OR lesions are immediately characterized by severe intoxication, accompanied by life-threatening disorders of the nervous system, respiratory and circulatory system.

In the case of a combined lesion (both radiation and chemical), extended medical care is provided to the victim in individual means of protection (gas mask, protective clothing).

Personal protective equipment

Individual chemical package. Designed for treatment (wiping) of exposed areas of skin and adjacent uniforms, as well as the front area of the gas mask when infected (suspected infection) PR (Fig. 129). With proper use of the contents of the package it is enough for two partial sanitization. Do not ingest the contents of the PPI vial.

In case of sudden use of PR by the enemy, it is urgent to put on a gas mask and a general military protective suit and carry out partial sanitation: open the PPI, remove the tampon (there are 4 cotton gauze tampons), moisten it with degassing solution from the bottle and use it as intended. At the end of the partial sanitation should be put onprotective gloves

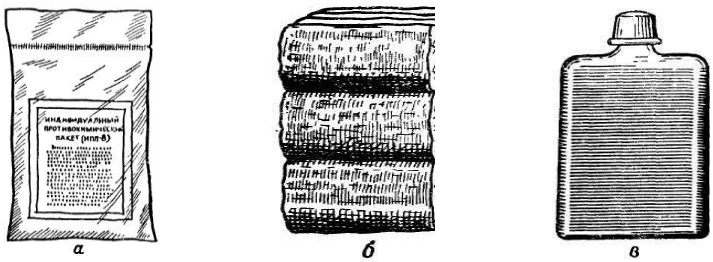

Fig. 1. Individual chemical package: a) general view of the package; b) cotton gauze tampons; c) a bottle of liquid

When providing assistance to victims without a gas mask, it is necessary to treat the face with a tampon soaked in degassing solution (protecting the eyes from

liquid PPI), after degassing wipe the skin in the eye area with a dry swab and put on a gas mask.

Respiratory protection. Respiratory protection includes: filtering, insulating gas masks and respirators. In addition, they are divided into general and special.

Filter gas masks. Provide reliable protection of the respiratory system, eyes, skin from toxic, radioactive substances, agents of biological weapons and toxins. The time of wearing a gas mask should not exceed 10 seconds.

Rules for wearing a gas mask.

To put on the gas mask, open the absorber valve, hold your breath, close your eyes, take off your hat, grab the lower edge of the gas mask helmet with both hands so that your thumbs are on the outside and the others are on the inside. Apply the lower part of the helmet-mask under the chin and with a sharp movement of the hands up and back, stretch it on the head so that there are no wrinkles and a good outlook. Then exhale completely, open your eyes and resume breathing.

When putting on a gas mask on the wounded, in the absence of enemy fire, it is necessary to put him in a comfortable position (between his legs), remove the helmet (hat) and put on a helmet-mask of gas mask as described above.

Under enemy fire, if the victim is lying on his stomach, he should also lie on his stomach, then take a helmet-mask so that the thumbs are inside and the others outside, bring it under the face of the wounded and put it on his head.

To protect the wounded with head injuries in the center of the WMD uses a helmet for the wounded in the head (Fig. 2).

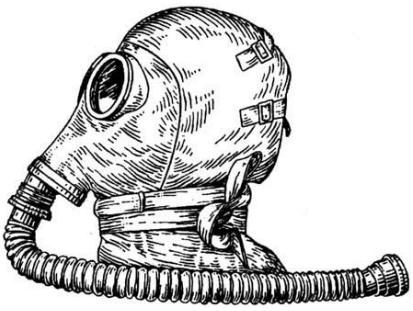

Fig. 2. Helmet for the wounded in the head

When putting a SP on a victim with a brain injury, bring his lower part under the chin, then unfold and put a helmet on his head.

When putting the SP on the victim with injuries of the jaws, face, it is necessary to widely stretch the inlet of the helmet, bring the base of the wedge-shaped valve under the nape, lift the head with one hand and pull the helmet on the head and face.

After putting on SHP, victims with craniocerebral injuries should be laid on their side, and with jaw injuries, the face - on the abdomen.

The wounded man, who is in a gas mask, SP, needs systematic supervision (examination of the skin of the face and pupils, control of respiration rate and pulse). In case of vomiting and contamination of the valves with saliva and vomit, it is necessary to urgently replace the SP.

After using the helmet, it is necessary for hygienic purposes to wash it with warm soapy water, wipe with a swab soaked in 2% formalin or alcohol solution, and air dry; carry out periodic inspections of its condition.

Insulating gas masks. The protective properties of insulating gas masks do not depend on the nature of the OP, radioactive substances, biological weapons agents or the concentration in the air. They apply:

- at very high concentrations of PR and harmful impurities in the atmosphere;
- in the presence in the external environment of such PR which are not kept by filtering gas masks;
- in the complete absence or lack of oxygen in the air;
- when forcing water obstacles or performing work at shallow depths.

Medical contraindications to the use of a gas mask:

- penetrating chest injuries and severe craniocerebral lesions;
- pulmonary, nasal and gastrointestinal bleeding;
- disorders of cardiovascular activity and respiration (attacks of asphyxia);
- abundant discharge from the nose;

Such wounded and sick should be accommodated in collective protection facilities equipped with chemical protection.

Gas training. In order to increase the body's endurance to the conditions of forced long-term use of gas masks, gas masks are performed under medical supervision. They consist in a consistent increase in physical activity and time spent in a gas mask. This allows you to strengthen breathing and heart muscles, to practice proper breathing.

Respirators and other respiratory protection. Respirators are a filter half mask used to protect against radioactive dust and bacterial aerosols. To check that the fitted respirator fits correctly, close the opening of the exhalation valve safety screen with your palm and exhale lightly. If air does not come out along the line of adherence of the respirator to the face, but only slightly inflates the half mask, the respirator is put on tightly.

Simple means of respiratory protection include cotton gauze bandages and dust masks (Fig. 3).

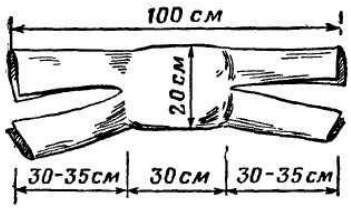

Fig. 3. Cotton gauze bandage

Respirators and simple means of protection are not suitable for protection against PR!

Skin protection. According to the principle of protective action, there are insulating and filtering means of skin protection.

Means of protection of insulating type by purpose are divided into general military and special.

All-military include a all-military protective set - protective cloak, stockings and gloves.

The protective raincoat can be used in the form of a cape worn in the sleeves and airtight overalls.

As a cape, the cloak is used in case of sudden use by the enemy of PR, agents

of biological weapons or in case of dropping of radioactive substances.

The protective cloak worn in the sleeves is used when overcoming on open machines the areas contaminated with PR or biological means of destruction, areas of radioactive contamination in the conditions of dust formation; when performing degassing, deactivation and disinfection works.

As a coverall, a protective cloak is used in areas heavily contaminated with PR or biological means of destruction, as well as during rescue operations.

Special means of protection of the insulating type (provide higher tightness in contrast to the general military) include a protective suit and a light protective suit. They are used for long-term actions of personnel in the infected area, for particularly dangerous work with PR, as well as for degassing, decontamination and disinfection work.

Filter-type protection means are designed to protect personnel from vapors and aerosols of PR. These include the all-military comprehensive protective suit (ZKZK), impregnated uniforms and underwear. In addition, ZKZK protects against light radiation of a nuclear explosion.

Contaminated air when passing through impregnated clothing is disinfected by interacting with receptors through which tissues are impregnated. The positive aspect of this protective clothing is its high ventilation capacity, which reduces the load on the body.

Materials for self-control:

TESTS:

1. Two hours after the completion of the work to eliminate the consequences of the terrorist attack, the victim N. was taken to the reception department. He complains of chest pain, shortness of breath during exercise, runny nose and profuse salivation. Consciousness is clear, cyanotic lips, acrocyanosis, moist skin. pupils narrowed. gmyofibrillation in the right forearm and right shoulder. When leaving the contaminated area, the protective equipment was damaged. What type of PR was used?

1. * OR neuro-paralytic action
2. PR of suffocating action
3. PR of general toxic action
4. PR of skin-abscess action
5. Severe carbon monoxide poisoning

2. A nuclear power plant is:

1. An industrial enterprise that holds nuclear stockpiles for peaceful use
2. An industrial enterprise that works to form a nuclear charge
3. * An industrial enterprise that runs on nuclear fuel to generate electricity
4. An industrial enterprise that uses any energy to produce nuclear elements
5. An industrial enterprise that deactivates RR

3. What level of the absorbed dose in grays causes a cerebral clinical form of acute radiation sickness?

1. 10-20 Gr
2. 30-50 Gr
3. 6-70 Gr
4. 5-15 Gr

5. *> 80 Gr

4. In what units is the absorbed dose of nuclear radiation measured:

1. X-ray
2. Pendant / kg
3. Joule / kg
4. Sievert
5. * Gray, glad

5. At what level of the absorbed dose in grays there is an intestinal clinical form of acute radiation sickness?

1. * 10-20 Gr
2. 80-100 Gr
3. 5-10 Gr
4. 100-120 Gr
5. 1-6 Gr

6. What are the clinical forms of acute radiation sickness:

1. bone marrow, transient, hemorrhagic, cerebral
2. bone marrow, transient, intestinal, cerebral
3. cerebral, bone, hemorrhagic, meningeal
4. * bone marrow, intestinal, toxemic, cerebral
5. bone, lung, intestinal, cerebral

7. Penetrating radiation is:

1. electromagnetic pulse
2. infrared rays
3. * flux of γ-rays and neutrons, which occurs during the fission of the atomic nucleus
4. an elementary particle that carries a negative charge
5. an elementary particle that carries a positive charge

8. At what level of the absorbed dose in grays there is a bone marrow clinical form of acute radiation sickness:

1. 7-10 Gr
2. 10-15 Gr
3. 1-6 Gr
4. 15-20 Gr
5. * 1-10 Gr

9. Stochastic effects of radiation exposure can be:

1. radiation burns, malignant neoplasms, leukemia
2. acute radiation sickness, radiation burns, radiation cataract
3. * malignant neoplasms, leukemias, genetic changes transmitted to offspring
4. chronic radiation sickness, radiation burns, leukemia
5. radiation sickness, hereditary diseases, thyrotoxicosis

10. At the radiochemical production there was a leak of radioactive aerosol with a significant content of iodine 131. What measures should be taken in the first place for personnel in the area of radioactive contamination:

1. * taking iodine preparations
2. taking a cyst mine

3. reception of sorbents
4. use of protective clothing
5. use of a respirator

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