Topic 1.4 “Harmful and poisoning impact of chemical agents. Identification of warfare poisoning agents.”

1.Harmfulagents Warfarepoisoningagents

Harmful agent – is an agent which can cause different traumas, diseases or another health deviations after the contact with living organism.

We can find these health deviations with contemporary methods during the act and farther in the future.

Classification of harmful agents:

- According to the damage effect:

1) Toxic agents – cause intoxication of the whole organism (mercury, cyanogen, plumbum, benzol);
2) Irritant agents - irritate respiratory center and mucous coats (chlorine, ammonia, acetone);
3) Sensitizing agents –cause allergic reactions (formaldehyde);
4) Oncogenic (cancerogenic)agents - cause cancerous diseases (nickel, chromium);
5) Mutagenic agents –cause alteration of inheritable traits;
6) Relevant to reproduction function agents (mercury, plumbum, radioactive agents).

- According to the practical use:

1) Manufactured (technical) poison: organicsolvents, dyestuff etc.;
2) Agricultural chemicals:pesticides, insecticides;
3) Drugs;
4) Domestic agents;
5) Biological agents – toxins;
6) Warfare agents (sarin, yperite, phosgene).

- According to the harmful degree/ 4 classes:

1 - Extra-hazardous (mercury);
2 - High-hazardous (chlorine, fluorine);
3 - Medium-hazardous (methyl alcohol);
4 - Low-hazardous (petrol, ammonia).

Toxicity – agent'sabilitytocausediseaseorevendeathindeterminedconcentration.
Entrance of toxic agents is possible:

- through lungs. In this case harmful dose is measured in mg per liter or in mg per cubic meter.
- with food or water (with forage) - harmful dose is measured in mg/kgof weight.

Thereare 4 characteristicquantitiesoftoxicagents.

1. Maximal permissible concentration (MPC) – allowance of harmful substances in the atmosphere with the absence of harmful impact. Quantity of MPC is different for different agents according to the degree of their harm.

2. Mediumthresholddose– such amount of toxic substances causesclinical manifestation of intoxication in a half of biological organisms;

3. Mediumincapacitatingdose– intoxication and clinical response in a half of biological organisms;

4. Mediumlethaldose - causes death among 50% of biological objects.

Types of poisoning effects:

1) Summaryeffect–is a sum of all poisoning effects of toxic components;

2) Enhanced effect – one toxic substance enhances another toxic substance;

3) Antagonistic – one toxic substance loosens another;

4) Independent - poisoning effect of the mosttoxicsubstanceincompoundprevails

Chemically hazardous objects.

Chemically hazardous object is a company or facility using chemically hazardous agents.

- **Massive destruction could happen in the case of an accident;**
- **E.g. chemical industry enterprises, oil-processing plants, refineries, treatment facilities and water works, using chlorine etc.**

Hotbed of chemical accident -

- **area of warfare agents ejection and wholesale destruction and human deaths as a result:**

zone of contamination – area of toxic agent's spread;

zoneofdestruction(is a part of zone of contamination) – area with humanor animal lesions and deaths.

Allchemicallyhazardoussubstancesdivideon 2 groups:

•fast-acting (clinicalpictureofpoisoningcomesimmediately);

•slow-acting(clinicalpictureofpoisoningoccursinseveralhours).

Hotbedwithfast-actingchemicalagents:

- **fast, momentarypoisoningandlesionofsignificantamountofpeopleoranimals;**
- **timeshortageforthefirstaid;**
- **itisnecessarytoprovidequickevacuationofcasualtiesfromthehotbed.**

Hotbed with slow-acting chemical agents:

- **- gradual occurrence of sanitary losses (in several hours);**
- **- enough time for the first aid;**
- **- gradual evacuation.**

2. The conception of chemical safety assessment

Timely medical aid (in the case of chemical accidents) is possible under the condition of early and preliminary preparation of appropriate forces and facilities.

There are 2 methods of chemical assessment:

Forecasting – allows to define main quantitative indexes of chemical accident consequences and to carry out necessary accountings for accident elimination;

Sanitary anti-gas intelligence – contamination assessment carries out by methods of rapid assay with portable devices (ПХР-МВ – PHR-MV, ВПХР – VPHR) portable laboratories, air-sampling screening, water-sampling screening, soil-sampling etc. These samples are delivered at fixed-site laboratory for the further examination and more accurate definition.

ПХР-МВ

ПХР-МВ (PHR-MV) – chemical-exploring device (medical, veterinarian)


ПРИБОР
химической разведки
медицинской
и ветеринарной служб
(ПХР-МВ)
Паспорт
ПХР-МВ


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ВПХР (VPHR) – armychemical-exploringdevice

3. Medical aidin the case of chemical poisoning

The main arrangements in the case of chemical accident:

- **Immediate treatment, specialized medical aid;**
- **Evacuating casualties;**
- **Patient's decontamination.**

Inthecaseofemergencywithenvironmentaldischargeofpoisoningagentsitis important to use:

- **Respiratoryorgansprotectivemeans: respirators, bulkydressings, wetpiecesoffabricetc.**
- **Antidotes;**
- **Fastevacuationofciviliansfromthehotbed;**
- **Tubelessgastriclavagewithplentyofwaterormilk, adsorbents.**
- **Partialdecontaminationofuncoveredpartsofskinandclothing.**

Protective means in the case of specific poisoning

1. Poisoning with dichloroethane:
- respirators, filtering gas-masks;
- protective gloves, shoes, special clothing;
- medical aid: nose and eyes irrigation with 2% solution of baking soda.

2. Poisoning with chlorine:
- filtering gas-mask or bulky dressing impregnated with 2% solution of baking soda (for respiratory organs protection)
-specialprocessing (treatment)isnotrequired.

3. Poisoning with phosgene gas and perchoromethel formate:

- **Filtering gas-mask or bulky dressing impregnated with solution ofurotropine(for respiratory organs protection)**
- **All casualties are needed in momentary evacuation from the hotbed**
- **Special processing (treatment) is not required.**

Protective means in the case of specific poisoning

4.Poisoning with carbon monoxide:

- **respirator with hopcalite cartridge or isolating gas-mask;**
- **special processing (treatment) is not required.**

5.Poisoning with hydrogen cyanide:

- **filtering respirator;**
- **all casualties are needed in immediate evacuation from the hotbed**
- **special processing (treatment) is not required.**

6.Poisoning with sulfuretted hydrogen:

- **isolating gas-mask (self-contained breathing apparatus)or bulky dressing impregnated with 2% baking soda;**
- **special processing (treatment) is not required.**

7. Poisoning with ammonia:

- **filtering respirator;**
- **quick evacuation;**
- **eyes irrigation and skin processing (decontamination) with 2% of boric acid.**

Antidotes

There are 2 phases of toxic process:

1. **Toxicogenic (toxic impact);**
2. **Somatogenic (clinical signs of poisoning include syndrome of intoxication which intensity depends on the poisoning severity and specific lesions depending on the way the agent influences the organism)**

Antidotes help only at the first stage of poisoning!

Toxins	Antidotes	Administration
Aniline, nitrites, cyanides.	Methylene blue	Intravenous infusion:1–2 mlof1% solution of methylene blue with 5% glucose solution.
Benzol, arsenic, plumbum, mercury, hydrocyanic acid.	Sodium thiosulphate	Intravenous infusionof 200 mlofsodium thiosulphate.

Toxins	Antidotes	Administration
Potassium bichromate, arsenic compounds, mercury compounds, chromium compounds, bismuth, cupric sulfate, lewisite.	Unithiol	Unithiolisanantidoteforheavymetalscompounds. Intravenousinjection. Dose: 10 mlof 5% solution (every 6-8 hours).
Sarin, soman,VX-gases, trichlorfon,dichlorvos.	Atropine	Intravenousinjection. Dose: 1-2 mginthecaseof mildpoisoning, 3-5 mginthecaseofseverepoisoningwithunconsciousness.
Methyl alcohol	Ethylalcohol	Per os (internally): 100 ml of 30 % solution.The procedure is performed five times. Intrevenousinfusion (undermedicalsupervision): 5% ofethylalcohol (1 mloneachkg of weight).

Toxins	Antidotes	Administration
Potassiumcyanid	**Nitroglycerine, amyl nitrite, methylen blue.**	**Amylnitrite – usingassmellingsalt. Methylen blue: intravenous injection:1–2 ml 1% methylenblue with 5% glucose solution.**
Carbon monoxide	**Acizol**	**1 pillina30 minutesbefore entering contaminated area. Protective effect lasts 2 hours. Next use in 2 hours.**

4. Special processing

Special processing. Decontamination

Itisnecessarytocarryoutspecialprocessing(decontamination) inthe hotbed of chemical accident and immediately after escaping.

Decontamination is the process of chemicals removing from any surface (e.g. clothing and skin).

2 types of decontamination:

1) Partial decontamination (only uncovered parts of skin and some clothing are undergoing a decontamination);

2) Full decontamination (all clothes and skin).

Only partial decontamination is possible in the hotbed of chemical accident (uncovered parts of skin, clothing and face part of respirator).

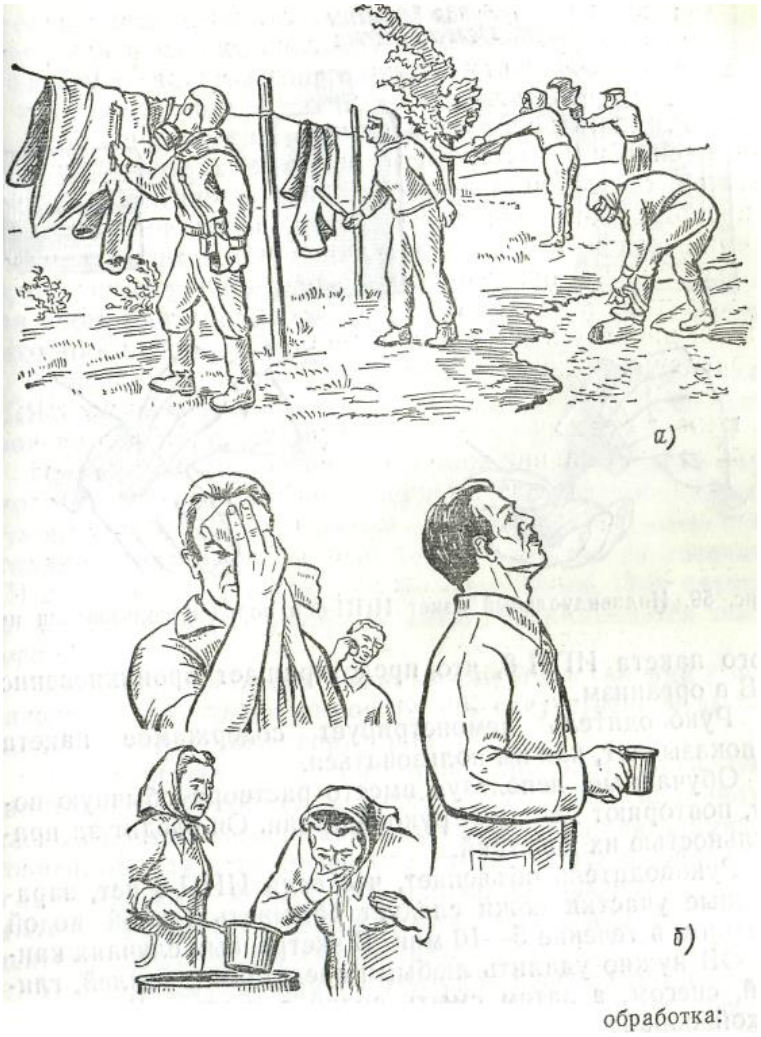
The rearespecial individual decontamination kits for this treatment (ИПП – 8, 10, 11 – Russ. abbr.)

Full decontamination (with undressing and exchanging clothing)isprovidedonlyinthenearesthospital.

Special treatment is a set of organizational and technical measures for the neutralization and removal of poisonous and toxic substances, radioactive substances and biological agents from the surface of the human body and various objects

Sanitation is a set of measures aimed at removing and neutralizing HVTV, BS, radioactive substances from the skin, mucous membranes, clothing, shoes and protective equipment for personnel, the wounded and sic

1.1 Types of special processing



обработка:

Partial special processing includes:

1. **partial sanitization of the population and rescuers, wounded and sick;**
2. **partial special processing of equipment (including ambulance transport), medical equipment and other items.**

Partial sanitization includes:

1. **in case of infection with toxic substances - degassing of open areas of the skin, adjacent clothing (collar, sleeve cuffs) and the front part of the gas mask;**
2. **in case of radioactive substances infection - decontamination of exposed skin, clothing and technical personal protective equipment;**
3. **in case of infection with bacterial agents- disinfection of exposed skin areas**

Complete special treatment includes:

- **Complete sanitary treatment of personnel, wounded and sick;**
- **Complete decontamination, decontamination and disinfection of equipment (including ambulance transport), medical equipment and other items, as well as the territory.**

Complete sanitary treatment of civil defense personnel, the wounded and the sick consists of washing the entire body with soap and water and a mandatory change of linen.

1.2 Methods of special processing

Physical methods of decontamination are based on the removal of toxic substances from contaminated objects by mechanical means;

- **using solvents (gasoline, kerosene, alcohol, acetone, etc.);**
- **using sorbents (silica gel, activated carbon);by evaporation when exposed to hot air.**

It should be borne in mind that, despite the fairly complete disinfection of the object after such treatment, toxic substances do not lose their toxic properties, therefore solvents, rags, tampons that were used for decontamination must be neutralized after its completion by chemical means or incineration.

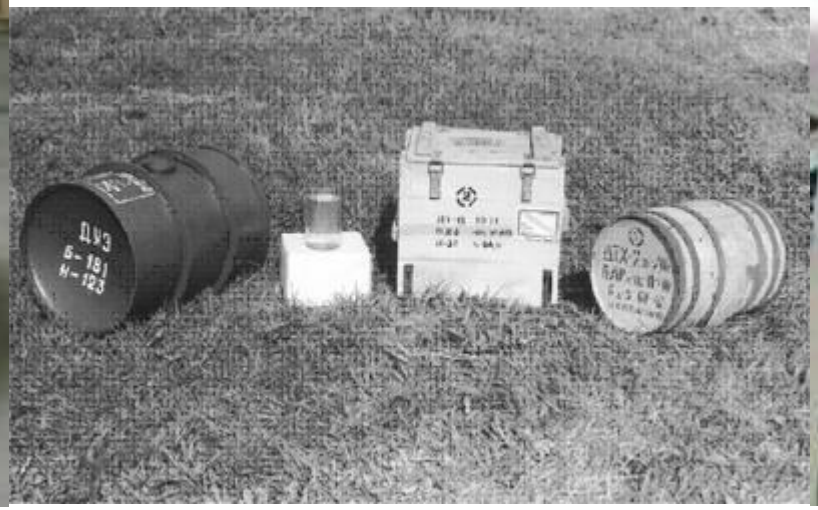
Chemical methods are based on the ability of toxic substances to undergo reactions of hydrolysis, oxidation, chlorination or binding to form harmless or low-toxic compounds.

For these purposes use:

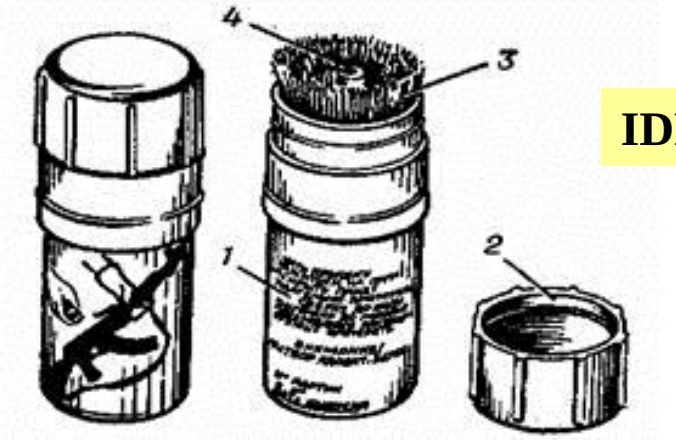
- **oxidizing agents (chloramine, dichloramine, calcium hypochlorite, etc.);**
- **alkalis (caustic soda, monoethanolamine, ammonia, etc.);**
- **polydehyde formulations with chloroactive and alkaline properties (liquid from individual anti-chemical packages -8, 9, 10).**

Standard degassing solutions are:Solution No. 1, containing a 5% solution of hexachlormelamine or a 10% solution of dichloramine in dichloroethane, neutralizes Vi-gases, mustard gases, lewisite;Degassing solution No. 2-bshch (ammonia-free alkaline), containing 10% sodium hydroxide and 25% monoethanolamine in water, neutralizes sarin, soman, diphosgene.

Degassing solution No. 2-ashch (ammonia-alkaline), containing 2% sodium hydroxide, 5% monoethanolamine and 20% ammonia, has similar properties; it differs from solution No. 2-bsch in its effectiveness at lower temperatures (up to – 40 o C).

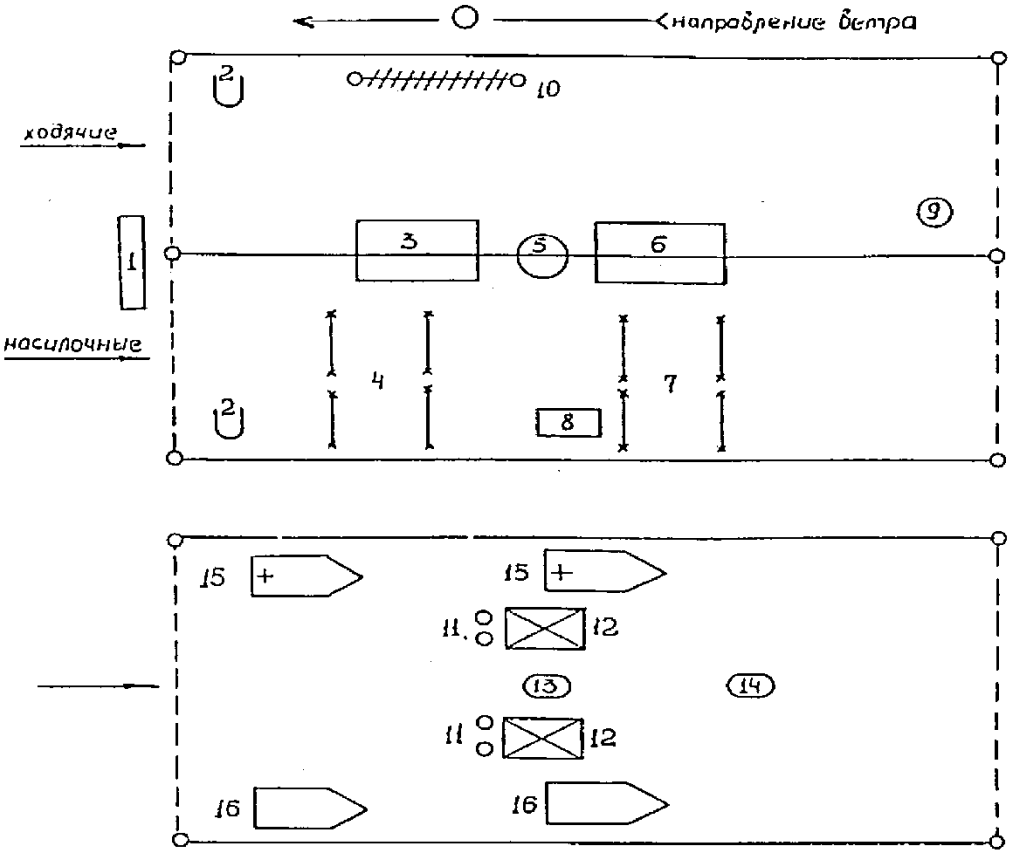


Question 5 “Organization and conduct of special treatment at the lesion site and at the stages of medical evacuation



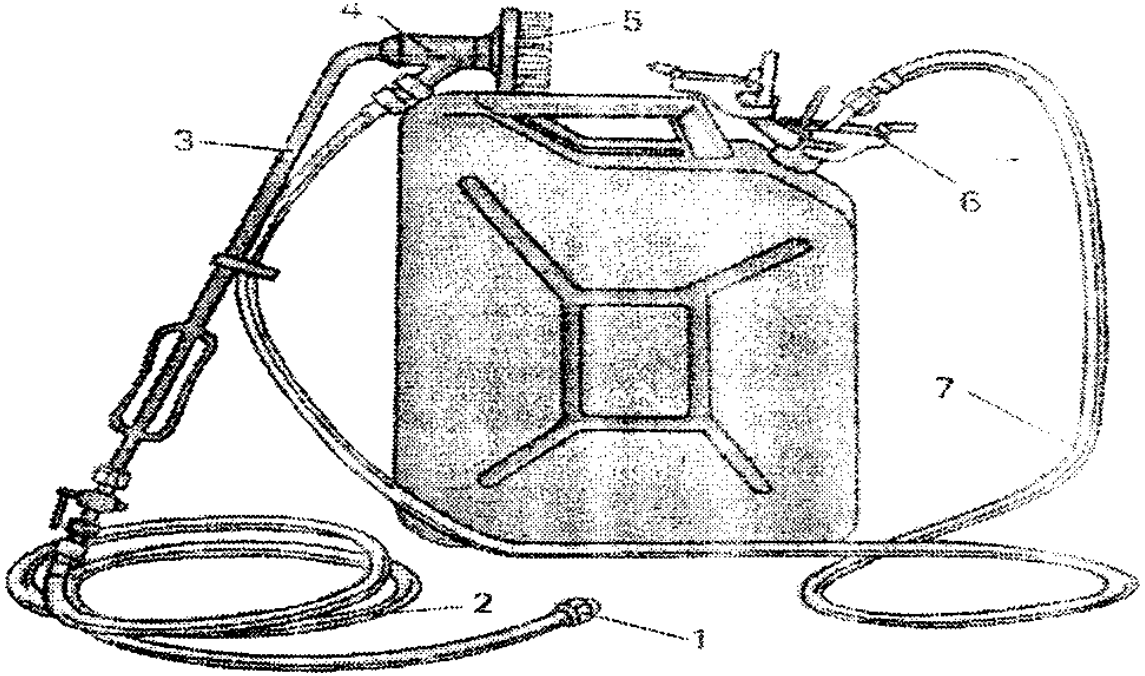
IDP - individual degassing package

Individual anti-chemical packages – IPP - 8

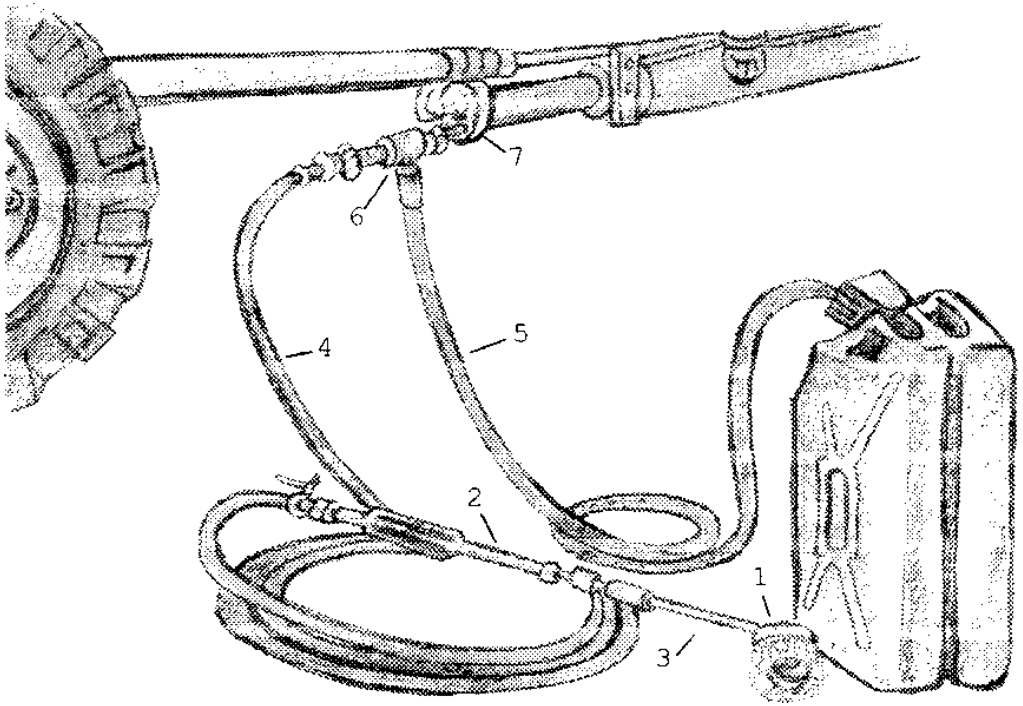


At the top is a site for sanitary treatment of personnel, wounded and sick, at the bottom is a site for special treatment of vehicles and property.1 – box for collecting equipment; 2 – bag for collecting contaminated personal protective equipment for the skin; 3 – table for anti-chemical agents (IPP, RDP-4, part of the IDPS-69 set, baths with soapy water, tampons); 4 – place for partial sanitary treatment of stretchers of the affected; 5 – pit for collecting dirty tampons and rags; 6 – table for antidote therapy; 7 – place for removing personal protective equipment for respiratory organs and putting on uncontaminated underwear and uniforms; 8 – linen exchange fund; 9 – washbasin;

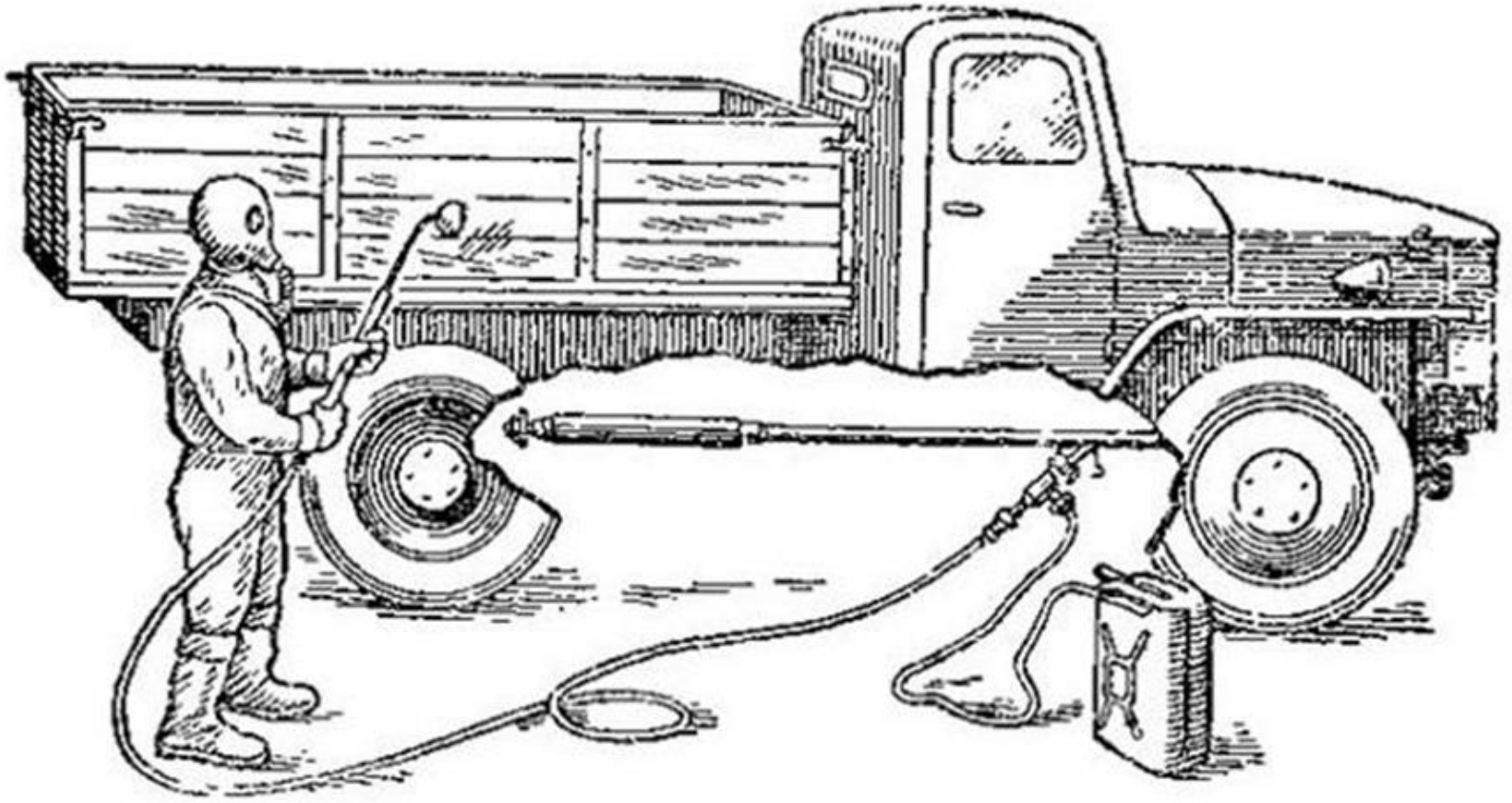
10 – rack with hangers for decontamination of uniforms; 11 – containers for degassing and decontaminating solutions; 12 – automotive kit for special processing of DK-4 equipment; 13 – place for special processing of stretchers and other medical equipment; 14 – place for a clean stretcher; 15 – ambulance transport; 16 – delivery vehicles (freight transport)



IDK-1 - individual degassing kit

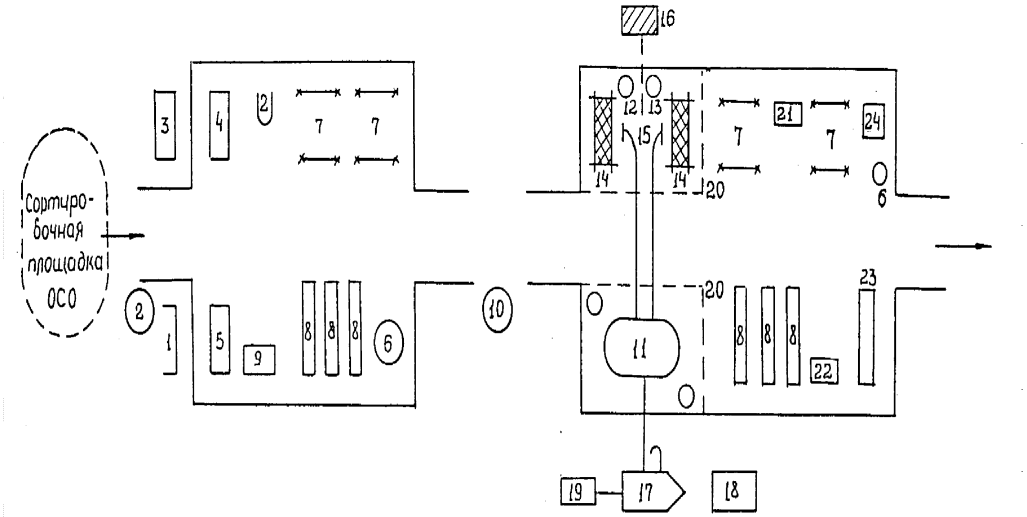


DK-4 – automotive kit for special processing of equipment



The action of the gas-liquid device is based on the use of exhaust gases from car engines. The device is connected to the exhaust pipe of the muffler and supplies the formulation from the container through a fire nozzle with a brush to the surface.

Organization and implementation of complete special treatment in a mobile hospital



Sanitation area of the special treatment department of the mobile hospital

1 – stretcher exchange fund; 2 – bags for collecting personal protective equipment; 3 – box for property; 4 – table for sorting marks, 5 – table for medical supplies and recorder; 6 – washbasin; 7 – stand for stretcher; 8 – benches for walking wounded and sick; 9 – set of CO (sanitary treatment); 10 – bag (box) for collecting respirators and gas masks; 11 – shower fixture; 12 – bucket (basin) for clean washcloths and soap; 13 – bucket (basin) for dirty washcloths; 14 – special stretchers on stands for sanitary treatment of stretcher wounded; 15 – portable shower nets; 16 – absorption well;

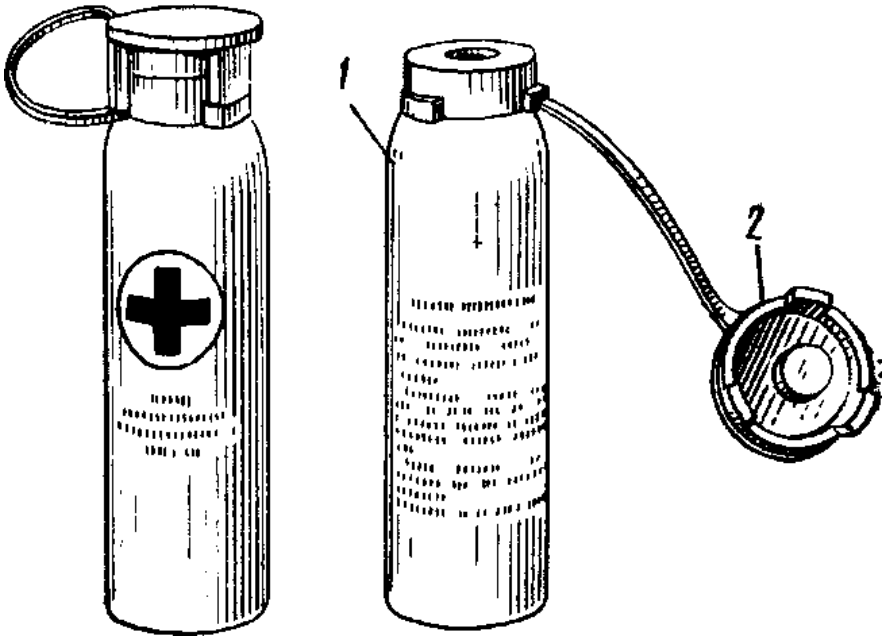
17 – disinfection-shower unit DDA (DDP); 18 – water tank; 19 – water tank; 20 – polyethylene film for washing; 21 – oxygen inhaler; 22 – table for medicines, sorting marks; 23 – rack with linen exchange fund; 24 – utility table (box for property)

Disinfection-shower vehicle DDA-66

Disinfection shower trailer DDP - 2

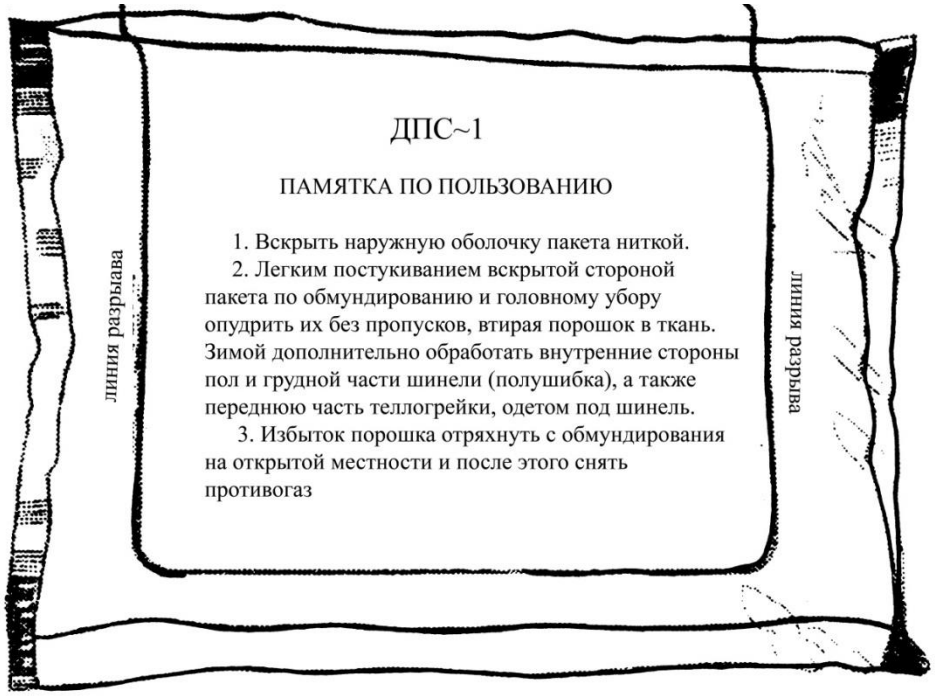
Technical specifications	ДДА-66	ДДП-2
1. Basic chassis	GAZ-66	Single axle trailer
2. Throughput - hygienic washing person/hour, summer/winter	56/56	48/48
- washing with simultaneous disinfection of equipment person/hour and set/person, summer/winter	40/28	32/32
3. Number of disinfection chambers, pcs.	1	1
4. Number of shower nets, pcs.	12	6
5. Service personnel, persons	3	2
6. Deployment time, min in summer/winter	40/60	30/40

ShR-3 helmet



Individual anti-chemicalIPP-10 package

Individual anti-chemicalIPP-11 package

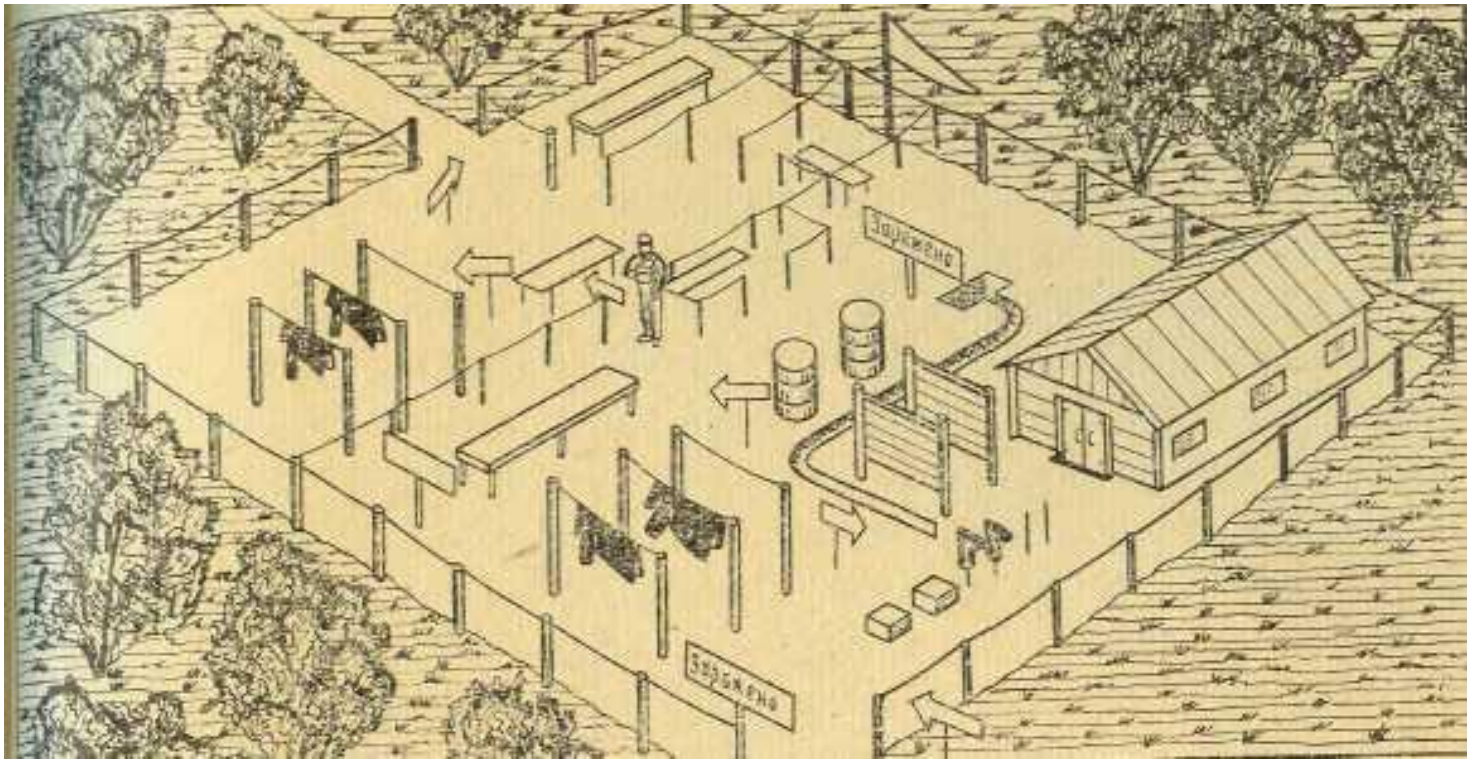


DPS – 1 degassing silica gel packet

The washing room is located in a fenced-off part of the tent type USB-56. On the one hand, places with perforated stretchers (on a rubberized base) and portable shower nets are equipped for washing severely injured people with warm water, on the other hand, for washing easily injured walking people under the shower device of the DDA installation. The washing room is equipped with containers with degassing and decontaminating solutions and basins; washcloths and extra soap.

In the washing room there are 2 paramedics and a driver-disinfector of the unit wearing safety glasses, anatomical gloves, sleeves and aprons. At the same time, 2 stretchers can be sanitized in the washing room; 2 – 3 sessile affected by toxic substances.

The site for special processing of clothing and property is located no closer than 50 m from other functional departments of the hospital on the leeward side near the sanitization site. The size of the site depends on the amount of property to be degassed and decontaminated. It also has dirty and clean halves. On the dirty half, the necessary means are placed for degassing and decontamination of clothing and property, drains and absorption wells are torn off, and fence signs are installed. On the clean half there will be places for storing processed uniforms and property.



Question 6 Special handling of medical property

Decontamination and decontamination of medical and sanitary equipment

Name of items	Degassing	Deactivation
Dressing material, sanitary straps	Boiling in a 2% soda solution for 1 hour. Large batches are sent to degassing.	Стирки с моющими средствами; при целой упаковке – обметание ее щетками, обтирание влажными тампонами. Большие партии подлежат хранению до спада радиоактивности.
cotton wool	If infected in pairs, ventilate for 1-2 days. In case of aerosol or droplet-liquid contamination - destruction	If the package is intact, sweep it with brushes and wipe it with damp swabs. If the seal of the packaging is broken - destruction.
Rubber products (tourniquets, breathing apparatus masks, heating pads)	Boiling in a 2% soda solution for 2 hours.	Rinsing with water or a decontaminating solution, wiping with damp swabs
Surgical instruments, syringes	Wiping with a dry swab, then rinsing in an organic solvent, followed by boiling in 2% soda solution for 1 hour.	Rinsing with decontaminating solutions, wiping with tampons moistened with solutions of complexing agents (1% EDTA solution, 10% sodium citrate solution)

Decontamination and decontamination of medical and sanitary equipment

Name of items	Degassing	Deactivation
Rubber objects used in surgical practice	In case of contamination by aerosols or droplets of persistent toxic substances – destruction. If infected by vapors, boil in a 2% soda solution for at least 2 hours	Rinsing with water or a decontaminating solution, wiping with damp swabs
Metal objects (operating tables, machines for the wounded, etc.), objects made of glass, porcelain	Treatment for infection with Vi-gases, mustard gases with solution No. 1, for infection with sarin, soman - No. 2-ashch (bshch) using IDK-1, DK-4	Washing with decontaminating solution SF-2u using IDK-1, DK-4, wiping with tampons moistened with solutions of complexing agents
Sanitary stretchers and military medical bags	Treatment for infection with Vi-gases, mustard gases with solution No. 1 using IDK-1, DK-4, for infection with sarin, soman vapors - treatment with DPS-1	Cleaning with brushes, washing with water or a decontaminating solution using IDK-1, DK-4