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TRANSLATION

PROTECTION AGAINST RADIOACTIVE SUBSTANCES AND WAR GASES

By

F. I. Kanets

FOREIGN TECHNOLOGY DIVISION

AIR FORCE SYSTEMS COMMAND

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PROTECTION AGAINST RADIOACTIVE SUBSTANCES
AND WAR GASES

BY: F. I. Manets

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F. I. Manets

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This brochure contains basic information concerning the combat properties of radioactive substances and war gases which are part of the armament of foreign armies, rules for the use of means of protection against radioactive substances and war gases, and the duties and performances of soldiers during radioactive and chemical reconnaissance and while overcoming contaminated regions; it also discusses how to carry out deactivation and decontamination of weapons and the sanitary treatment of personnel and how to approximately determine the radiation dose during operations in a region contaminated by radioactive substances.

The brochure is intended for military personnel of the Soviet Army and Navy. It will certainly also be useful to youths of premilitary age, military reservists, and to a large number of readers who are interested in questions of protection against weapons of mass destruction.

INTRODUCTION

The Soviet people guided by the Communist Party have successfully completed the gradual conversion from Socialism to Communism. Occupied with the development of the majestic structure of Communism, our people carry on the unremitting struggle for peace throughout the world.

N. S. Khrushchev, President of the Council of Ministers of the USSR and First Secretary of the Central Committee of the Communist Party, has repeatedly pointed out the firmness of the peaceful policy of our government and the resolution to secure total disarmament and, in addition, the elimination of nuclear weapons and other means of mass destruction. Moreover, we are constantly mindful of the attempts of reactionary circles of the imperialist powers, above all the United States of America, to unleash a new third world war. Modern science has placed in the hands of the imperialists various means of mass destruction which possess unprecedented military capabilities. Therefore, our people have displayed constant concern over strengthening the defense of the Soviet government and have placed in the hands of our soldiers the best weapons and equipment in the world.

The use by the enemy of nuclear and chemical weapons in a future war will create vast areas contaminated by deadly radioactive materials and war gases. However, against these materials we have sufficiently reliable methods and means of protection, the use of which will permit the troops to maintain fighting efficiency and to successfully carry out military missions.

It is the duty of each soldier to be thoroughly familiar with the capabilities of nuclear and chemical weapons, to improve his

ability to carry out combat operations under conditions of radioactive contamination and chemical effects and thus be prepared to defend our beloved country.

PROTECTION AGAINST RADIOACTIVE SUBSTANCES AND WAR GASES

by

F. I. Manets

CHAPTER 1

RADIOACTIVE SUBSTANCES AND WAR GASES

Radioactive substances and war gases are various means of mass destruction. Constant attention is given to these means, in addition to nuclear weapons, in the armies of imperialist governments which are preparing for a third world war; in the opinion of the most shameless haters of mankind, radioactive materials and war gases are the most suitable means for mass destruction of people, which ideologists of the bourgeoisie consider as the ultimate purpose of war.

Basic Properties of Radioactive Substances

The isotopes of a number of chemical elements whose nuclei are capable of spontaneous radioactive decay are called radioactive substances.

Radioactive decay is accompanied by radiation fron the disintegrating nucleus of an alpha-particle, a beta-particle, or a gamma-ray. On disintegration of the nuclei of a number of substances, the simultaneous radiation of an alpha- or beta-particle and a gamma-ray is possible.

The harmful effect of the radioactive substances is due to the reaction of alpha- and beta-particles or gamma-rays on the organism. The effects of these rays causes a specific illness of the organism — radiation sickness.

Alpha- and beta-particles do not have the property of deep penetration into various media situated in their path after radiation from the nucleus. In air the path length of alpha-particles is approximately 10 cm, and of beta-particles — not more than 100 cm. If media of greater density than air are located in the path of alpha- and beta-particles, their path length is that much less. For example, alpha-particles cannot penetrate a sheet of writing paper, while beta-particles cannot penetrate an aluminum plate 1 mm thick.

Alpha-particles penetrate into human tissue only through the outer layer of skin; beta-particles, although they have greater penetrability, also cannot penetrate deeper than several millimeters. However, we can never assume that alpha- and beta-particles do not have a dangerous effect upon the human organism. If there is no opportunity to remove the alpha- and beta-active substances from the body, then inflammation of the skin may begin and sores can appear. Particularly great damage is done when alpha- and beta-particles enter an organism, for example, with contaminated food or water, or by inhalation.

With external irradiation, gamma-rays, which possess great energy and penetrability, are the fundamental source of radiation sickness. Gamma-rays, similar to X-rays, penetrate right through the human body, disrupting the biological structure of the tissue.

The nature of the changes in human tissues resulting from irradiation with gamma-rays and, consequently, the degree of radiation sickness depend on the radiation dose: The larger the dose, the

more molecules of tissue are subjected to injury and the more serious and rapid is the development of radiation sickness. It has been established that a single radiation dose of up to 50 roentgen (r) is not dangerous since the organism is capable of self-recuperation from slight injuries of the tissue and organs. A radiation dose of 100-200 r causes slight sickness, while a dose up to 400 r leads to serious illness, resulting in the death of up to 50% of the injured ones.

Radiation sickness as a result of radioactive irradiation of an organism develops in stages. Its symptoms are: headache, general lethargy, weakness, high temperature, gastro-intestinal disorder, bleeding of the skin and loss of hair.

The stages of radiation sickness can be traced by using as an example the Japanese fisherman who on March 1, 1954 were exposed to radioactive fallout from the hydrogen bomb exploded by the Americans in the vicinity of Bikini Atoll.

The Japanese vessel "Lucky Dragon" was located 160 km from the site of the explosion of the American hydrogen bomb. On the day of the explosion of the bomb, as told by the victims, grayish-white ash fell on the boat for 5 hours. On the evening of that same day, the crew complained of headaches, loss of appetite, and pain in the eyes; later nauses and vomiting developed and several fisherman developed diarrhea. Between the second and fifth days after the explosion a painful rash was observed on many of the afflicted fishermen and the parts of the skin which were not protected by clothing began to peel. After a week certain fishermen complained of bleeding of the gums and loss of hair. After lengthy hospital treatment 22 fishermen recovered, but one died.

Radioactive substances do not have a specific odor or other indications which are inherent, for example, in the majority of toxic substances. Therefore it is practically impossible, by external indications, to determine their presence in a region or local objects. The determination of radioactive substances is carried out by means of special — dosimetric — instruments.

Sources and Nature of Radioactive Contamination

The basic source of radioactive contamination under combat conditions is nuclear explosion.

A nuclear explosion accompanied by the release of intranuclear or atomic energy is characterized by the action of a tremendously powerful shock wave, intense luminous radiation, penetrating radiation, and radioactive contamination of a locale.

The shock wave destroys buildings and structures, puts military equipment out of commission, and, when humans are involved, causes contusions, fractures, and traumas. Luminous radiation causes fires of forests, crops, inflammable buildings and structures and can cause serious burns to a person. Penetrating radiation, like radioactive substances, causes radiation sickness.

Radioactive contamination of a locale and also of the people, military equipment, and weapons located in it is due to the fall-out, from a nuclear explosion cloud, of fission fragments and the unreacted part of the exploding material, and also to the formation of synthetic radioactive isotopes.

The radioactive isotopes of certain elements which form during the fission of the nuclei of atoms of the material of the nuclear charge are called fission fragments. Within a certain time fission fragments disintegrate and their decay is accompanied by the emission

of beta-particles and gamma-rays.

Uranium or plutonium, which in themselves are radioactive elements, are usually used as the nuclear charge. On explosion of a nuclear shell, part of the uranium or plutonium does not undergo fission and falls out in its usual form; alpha-particles are emitted during the disintegration of uranium or plutonium. The role of unreacted substances in the radioactive contamination of a locale is very small, as a rule, compared with that of fission fragments.

Synthetic radioactive isotopes are formed as a result of the effect of a powerful flux of neutrons released at the moment of the nuclear explosion on the nuclei of atoms of various chemical elements situated in the casing of the nuclear shell, in the ground, in weapons, and in supplies. The process of the formation of synthetic radioactive isotopes is called induced radioactivity.

The degree and size of the zone of radioactive contamination, according to the foreign press, depend on many factors, mainly on the type of nuclear explosion.

Nuclear explosions can be atmospheric or surface. An atmospheric explosion is one which takes place at a height of several hundred meters above the earth's surface; the point on the earth's surface above which an atmospheric nuclear explosion is conducted is called the epicenter of the explosion. Surface nuclear explosions occur directly at the earth's surface or at a height of several tens of meters; the point on the earth's surface at which a surface nuclear explosion takes place is called the center of the explosion.

The foreign press has noted that with atmospheric explosions of nuclear devices dangerous contamination can be observed only in the region of the epicenter and only for several minutes, at that.

Contamination in the region of the epicenter of an explosion is determined mainly from induced radioactivity.

Contamination in the path of a radioactive cloud during an atmospheric explosion will be insignificant since the radioactive products are scattered over a large area. It is usually not dangerous to troops.

With surface explosions of nuclear weapons the luminous region of the explosion is in contact with the ground, as a result of which a significant part of the radioactive products of the explosion mixes with the fused soil, part of which is scattered by the shock wave. Consequently, in the zone directly bordering on the center of the explosion the entire terrain is covered with a layer of slag having high activity. The remainder of the fused soil and also the radioactive dust raised by the wave form into a cloud under the influence of the ascending air currents.

As the explosion cloud ascends, a certain portion of the radioactive products which settle out into the largest dust and slag particles fall from the cloud in the region of the explosion, thus intensifying the contamination of the terrain bordering on the center of the explosion. However, most of the radioactive soil does not fall out in the region of the explosion but remains in the cloud which, rising to a certain height, is carried along by the wind. In this case, radioactive substances fall out along the entire part of the cloud, forming a band of contaminated terrain up to 100 or more kilometers long and more than 10 kilometers wide. This contaminated band of terrain is called the track of the radioactive cloud.

The levels of radiation in the track of the cloud, depending on the distance from the center of the nuclear explosion and on the

caliber of the shell have very high values, reaching in certain places hundreds and even thousands of roentgens per hour.

The degree of radioactive contamination also depends greatly on meteorological conditions. With rain, snow, or fog, the contamination will be stronger since in this case a larger amount of radioactive dust falls to the ground together with rain drops or snowflakes. It is also quite obvious that the greater the wind velocity at the altitudes at which the radioactive cloud is moving, the smaller the size of the locale contaminated with high levels of radiation, since there is scattering of the radioactive products over a broader area and, consequently, a decrease in the density of contamination.

Foreign sources consider that a characteristic feature of regions contaminated by radioactive materials is a rapid decrease in their activity. Therefore, even highly contaminated regions (with radiation levels of the order of 100-200 r/hour) after several days becomes low-hazard, and in some cases even completely safe.

Brief Characteristics of War Gases

War gases are chemical compounds which, when used in combat, can destroy unprotected manpower.

War gases and the means by which they are used on the battlefield make up the concept of a chemical weapon. War gases are the basis of the destructive effect of a chemical weapon.

A characteristic feature of war gases is their ability to penetrate into structures which are not anti-chemically equipped, and also into tanks and other combat vehicles, and to destroy the personnel inside them. War gases can maintain their destructive effects in the air, on the ground, and on various objects over a sometimes

long period of time.

The behavior of war gases in a locale depends to a significant degree on weather conditions and the nature of the terrain. The harmful effect of a number of war gases decreases as a result of their evaporate absorption into the ground, and chemical decomposition by precipitation and atmospheric oxygen. With a high air temperature and strong winds, war gases evaporate more quickly than at low temperatures and low wind velocity. Heavy rain speeds up the decomposition of war gases and washes them out of the soil. Contaminated air will remain longer in ravines, hollows, trenches, woods, underbrush, and thick and high grass than in an open area.

The vapors of war gases, which are particularly highly toxic, can spread with the wind for several kilometers from the region of their direct application.

War gases used in foreign armies are arbitrarily divided into persistent and nonpersistent. The term persistency is used to describe the ability of war gases to retain their harmful effect over a certain period of time after application.

Persistent war gases retain their damaging effect from several hours to several days and even weeks. Mustard gas, lewisite, TABUN, and sarin are examples of these.

Non-persistent war gases maintain their damaging effect for several minutes, sometimes hours. Such gases include phosgene, diphosgene, and hydrocyanic acid (prussic acid).

Regarding the nature of the effect on the organism, war gases at the disposal of foreign armies are divided into substances having convulsant-paralysant, common toxic, skin irritant, choking, and acrid effects.

Paralysant gases attack the blood and the nervous system. Such gases include sarin, soman, and TABUN.

Sarin - a colorless or yellowish liquid with almost no odor. It causes damage through the respiratory system, the skin, and the intestinal-digestive tract; damage through the skin is caused by both the liquid drop and the vapor form.

When small (thousandths of a milligram per liter) concentrations of sarin vapor are used, as reported by numerous foreign authors, there occur contraction of the pupils (miosis), salivation, and difficulty in breathing; with concentrations of the order of hundredths or tenths of a milligram per liter, there is observed, in addition, the loss of consciousness, paralysis of the limbs, acute convulsions, and, as a result of poisoning, death.

Liquid sarin does not have a skin irritant effect but its penetration through the skin to the blood causes the usual poisoning.

Soman - a colorless liquid with a faint odor of camphor. It is one of the most powerful war gases in the arsenal of foreign armies; judging from information in the foreign press its toxicity is 2-3 times greater than that of sarin.

The symptoms of soman poisoning are the same as sarin poisoning.

TABUN - a reddish-brown liquid with the faint odor of fruit. The nature of its effect on the organism is the same as for sarin, but it is less toxic.

Common toxic gases attack the blood. A typical example of a substance in this group is prussic acid.

Prussic acid - a colorless easily vaporized liquid, with an odor resembling that of burnt almond.

Characteristic symptoms of prussic-acid poisoning: a metallic

taste in the mouth, courseness in the throat, dizziness, weakness, nausea. Then there appears acute shortness of breath, slowing of the pulse, loss of conciousness; sharp convulsions and restriction of breathing sets in.

Skin irritant gases attack the skin, eyes, respiratory organs and digestive organs. Examples of these are mustard gas and lewisite.

Mustard gas - a darkish-brown oily liquid with a characteristic odor resembling that of garlic or mustard. Being heavier than water, it slowly evaporates from contaminated regions. With prolonged boiling in water it decomposes forming non-toxic substances.

Mustard gas has multiple effects on the organism:in the droplet and vapor form it attacks the skin and the eyes; in vapor form it attacks the respiratory system and lungs; when it gets into food or water it internally damages the digestive organs.

Drops of mustard gas are quickly absorbed into the skin without causing any feelings of illness. After 4-8 hours (the latent period) redness appears on the skin and itching begins and towards the end of the first or the beginning of the second day there appear blisters containing a clear yellow fluid which in time becomes turbid. Within 2 or 3 days the blisters burst and form sores which do not heal for a long period of time.

Lewisite - a heavy oily liquid, dark brown in color, with an odor resembling that of geranium leaves. It evaporates rapidly forming dangerous concentrations in the contaminated areas.

Lewisite has the same multiple effects as mustard gas. However, it has almost no latent period at all: upon contamination there appears rapid irritation of tissues, mucous films of the upper respiratory tract and eyes; after several minutes there appears a

redness on the skin and an extreme burning sensation.

Lewisite penetrates the skin more quickly than mustard gas, is carried by the blood throughout the organism, and causes severe intoxication; the skin heals the more rapidly, the less severe the damage.

Mustard gas and lewisite vapors acting on the human body cause damage to the skin and eyes. The most delicate parts of the body: the groin region, the reproductive organs, and the armpits, are particularly sensitive to the effects of the vapors of these gases.

Lung irritant gases mainly affect the lungs. Phosgene is a typical gas of this group.

Phosgene - a colorless liquid with an odor resembling that of moldy hay. It vaporizes completely at a temperature of $+8.2^{\circ}$.

Phosgene acts on the organism in the gaseous state. A characteristic feature of phosgene is its latent period, lasting 4-6 hours. With large concentrations of phosgene vapor there is no latent period.

Under the influence of phosgene one smells moldy hay and experiences an unpleasant taste in the mouth; then he experiences slight dizziness and weakness. Upon coming out of the contaminated air one feels well again, and the symptoms of poisoning rapidly disappear. But after 4-6 hours, a turn for the worse sets in: cyanosis of the lips, cheeks, and nose rapidly develops, and there is over-all weakness, headache, increased respiration, labored breathing, and painful coughing with copious emission of phlegm.

Acrid gases, according to experience in World War I (1914-1918), were intended to paralyze the combat operations of troops. Such gases include adamsite (sneezing gas) and chloroacetophenone (tear gas).

According to foreign sources, acrid gases have now lost their significance and have been eliminated from the list of combat materials. In the United States, for example, they are now used as a police weapon for, as the American press has noted, "the suppression of disorders."

According to the views held by foreign armies, war gases can be used in chemical, aviation, and artillery ammunition, chemical and land mines, and also by means of special machines and devices.

CHAPTER 2

MEANS OF PROTECTION AGAINST RADIOACTIVE SUBSTANCES AND WAR GASES

Individual and collective means of protection are used against the effects of radioactive substances and war gases.

Individual Means of Protection

Individual means of protection are used to protect individuals from damage by war gases and radioactive substances. For protection of respiratory organs, the eyes, and the face, a gas mask is used; for protection of the skin, a protective cloak (or protective coat), protective stockings and gloves, protective clothing, and a protective apron are used.

Individual means of protection can be in one of three positions:

"field" - with no direct threat of radioactive contamination and chemical attack;

"ready" - for a direct threat of radioactive contamination and chemical attack by the enemy; and

"combat" - at the beginning of a chemical attack and the discovery of radioactive substances in the air or on the ground.

The gas mask (Fig. 1a) consists of a gasproof cannister and a

facepiece (head mask). The gas-mask kit also includes a gasproof pack, warming sleeves, and non-sweating films or a special "pencil" to prevent sweating of the eyepieces.

Figure 1. Individual means of protection: a) gas mask; b) protective cloak (in combat position); c) protective stockings (in "combat" position); d) protective gloves; e) light protective uniform (in "combat" position).

The gas mask supplied in the Soviet Army provides protection against all known war gases and also against radioactive substances. It is necessary only to constantly maintain the gas mask in good condition and to accurately observe the rules for its use.

When obtaining a gas mask it is necessary to precisely select the head mask according to the size of the head and face. If the head mask is large, contaminated air will freely enter, by-passing

the cannister, and thus cause damage. A small head mask squeezes the head and face, causing pain; it is impossible to wear such a mask for a long period of time.

The gas mask is selected according to size, which is determined by measuring the head in a closed line which passes through the crown of the head, the chin, and the cheeks and a line connecting the openings of both ears and passing along the forehead across the superciliary arches. If the sum of both lines adds up to 92 cm, then a size zero mask is selected; if the sum of measurements is 92-95.5 cm, size one; 95.5-99 cm, size two; 99-102.5 cm, size three; and more than 102.5 cm, size four.

Upon obtaining a gas mask it is then necessary to check its working condition. This is done first by external examination of the gas mask, valve box, connecting hose, cannister, and pack, and then by checking the gas mask for air-tightness.

The air-tightness of the gas mask is checked as follows. It is necessary to put on thehead mask, take the cannister out of the pack, cover the opening at the bottom of the cannister with a rubber plug, and deeply inhale. If air does not pass through under the head mask, the gas mask is operating properly; otherwise, a second external examination is made to determine the fault and to correct it or, if the commander so indicates, change gas masks.

Finally the correct selection of the head mask and proper working order of the gas mask is checked in a smoke chamber (or in a building adapted for that purpose) with a specific concentration of war gas.

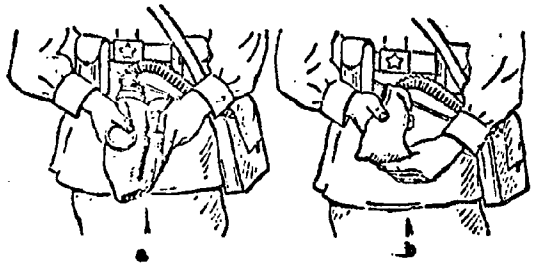


Fig. 2. Folding the head mask of the gas mask.

The connected cannister and head mask are packed into the gas-mask pack. To pack the head piece, take it in the right hand by the eyepiece so that the seam and eyepiece are turned to the right, with the left hand fold the head mask lengthwise covering the right eye-piece with it (Fig. 2a), then fold the head mask across, covering the left eyepiece with it (Fig. 2b) and with the left hand insert the con-necting tube into the pack compartment for the facepiece and with the right hand lay the folded head mask with the valve box down.

In the "field" position the gas mask is carried on the left side and placed slightly towards the back so that it does not interfere with the movement of the left arm when walking. The valve of the gas-mask pack must be turned away from the person (in the field) and fastened; the upper edge of the pack is at belt level (the length of the shoulder strap is adjusted by a movable buckle). The strap of the pack must be under the straps of the field pack.

In a tank, a self-propelled artillery vehicle, or in other mil-itary vechicles the gas mask, like other materials for protecting the crew, is stored in a place designated by the commander.

To transfer the gas mask to the "ready" position it is necessary

to move the gask mask slightly forward, unhook the pack valve, remove the lacing (strap) and use it to secure the gas mask to the body. The headgear should be prepared for quick removal from the head.

The gas mask is transferred to the "combat" position at the command "Gas," at a signal reporting chemical attack, or individually when war gases or radioactive substances are detected in the air or on the ground.

The gas mask is transferred to the "combat" position by placing the facepiece over the face and head. Remove the head mask from the pack, take it in both hands at the thicker edge of the bottom part so that the thumbs are on the outside and the other fingers are on the inside of the head mask (Fig. 3a); then place the lower part of the head mask under the chin and with a rapid upward and backward movement of the arms pull the head mask over the head (Fig. 3b) so that there are no wrinkles and the eyepieces fit against the eyes.

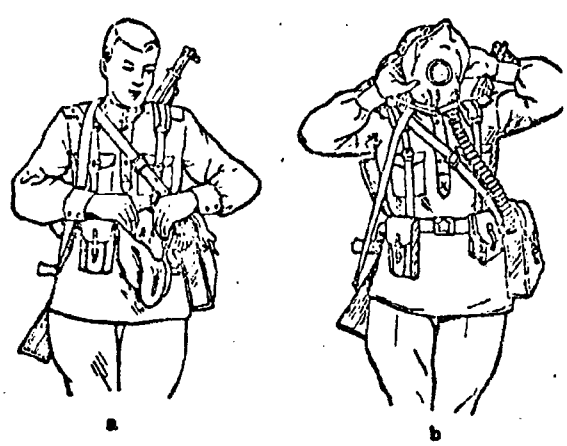


Fig. 3. Transfer of the gas mask to the "combat" position.

When putting on the gas mask it is necessary to hold the breath and close the eyes in order not to allow contaminated air into the lungs and to protect the eyes from damage. Having put on the gas mask one should forcefully exhale in order to remove the contaminated air which might have entered under the head mask while putting it on; then, open the eyes, resume breathing, put on the helmet, and continue to carry out the combat mission.

The gas mask is taken off at the command "Remove gas mask." For this, one hand lifts the helmet (Fig. 4a) and the other takes hold of the valve box; pull the head mask slightly downward, and with a forward and upward motion of the hand remove the head mask (Fig. 4b). Then replace the helmet, twist off the head mask, wipe its surface with a clean cloth or dry it out thoroughly, and place it into the pack.

Fig. 4. Removing the gas mask.

The driver of a vehicle removes his gas mask with the left

hand while continuing to drive the vehicle, and at the first stop stores the gas mask.

When the gas mask is damaged — a leak in the head mask or connecting hose, a puncture of the cannister, one should know how to use it until it can be replaced by a new one.

When there are large holes in the head mask, one should hold the breath, close the eyes, and take off the head mask; then unscrew the connecting hose from the head mask, place the threaded connector of the connecting hose in the mouth, hold the nose, shut the eyes, and breath through the mouth (Fig. 5a). One takes exactly the same steps for a damaged valve or broken glass. If the puncture of the head mask is small, then the torn place can be held tightly with the fingers or pressed by the palm to the face.

With a puncture of the connecting hose one should hold the breath, close the eyes, unscrew the connecting tube and screw the cannister directly to the valve box (Fig. 5b).

With a leak in the cannister it is necessary to cover the leak with the palm, the fingers, or a handkerchief, and then stop up the hole with clay, dirt, or bits of bread.

The protective cloak (Fig. 1b) serves to protect clothing, equipment, and exposed parts of the body against contamination by radioactive substances and liquid war gases. The cloak is made from a special paper which has a protective covering.

In the "field" position the cloak is in a paper envelope which is stored in a special compartment of the gas-mask pack. To get the cloak in the "ready" position one must take it from the envelope and place it back into the gas-mask pack.

Fig. 5. Using a damaged gas mask.

The protective cloak is put into the "combat" position as follows. Turn facing the wind, grip the weapon between the knees and, having taken the cloak by the front part of the hood, put it on with an upward and backward motion of the hands. Then turn the back to the wind and holding the flaps by their loops, wrap the cloak around the body.

When it is necessary to lie down in the protective cloak, drop to the left knee on the left flap of the cloak and then lie down on the left side, pulling the legs up. In order that the right flap not blow in the wind it is held to the ground by the legs. The weapon is kept under the cloak.

In order to remove the protective cloak it is necessary to face the wind, place the weapon between the knees and, having raised

the cloak upward and slightly backward (Fig. 6), take the cloak off with a wide sweep of the arms to the sides so that the contaminated side of the cloak does not touch the uniform or equipment.

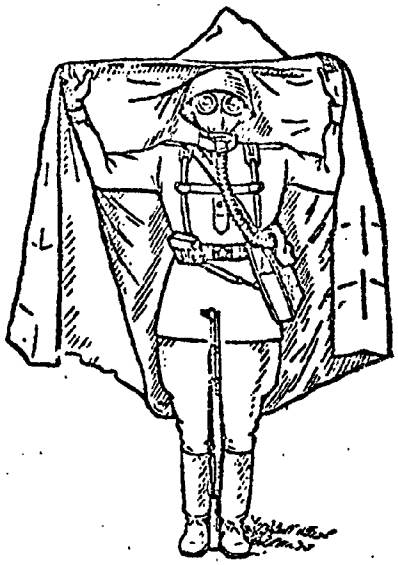


Fig. 6. Removing the protective cloak.

There is also a cloak-pad. This is used to protect the uniform, equipment, and exposed parts of the body from contamination by radioactive substances and persistent war gases mainly when overcoming contaminated terrain on foot; the cloak-pad is used when lying down in a contaminated region.

The protective poncho has the same purpose as the protective cloak. In addition, the poncho can be used as protective clothing during comparatively prolonged operations in a contaminated locale and when carrying out certain deactivation and decontamination operations.

The protective poncho is made from a special rubberized fabric.

Protective stockings and gloves (Figs. 1c and d) protect the legs and hands against contamination by radioactive substances and liquid war gases. They are made from a special fabric.

The soles of the protective stockings are reinforced with a canvas or rubber vamp. Stockings with a canvas vamp have two or three laces each for attachment to the legs and one lace each for attachment to the belt; stockings with a rubber vamp are fastened to the legs by means of straps, and to the belt by a lace.

There are two types of protective gloves: summer and winter. Winter gloves have an insulating liner which is fastened by buttons.

Protective stockings and gloves in the "field" position, as a rule, are carried in a vehicle, usually in a special case. In order to get them in the "ready" position the case containing the stockings and gloves is fastened to the belt, and if there is no case, harness the stockings and gloves to the belt in front.

Protective stockings are put on over the boots; the tops of the stockings are pulled on and wrapped about the legs so that the folds are on the outside.

To remove the stockings, unfasten the laces, unfasten the straps, and then, in turn, put the toe of one foot on the heel or the side of the heel of the vamp of the other stocking, fold down the top half of both stockings, and then lightly shake the legs free from the stockings (Fig. 7) and withdraw to an uncontaminated location.

Protective stockings and gloves contaminated by war gases are collected and sent to decontamination points, while those contaminated by radioactive substances are deactivated separately by thoroughly washing then with water or wiping them with a cloth, grass, or snow.

In those cases when protective stockings and gloves are uncontaminated, they are stored for future use.

Protective clothing is used for prolonged operations in a contaminated locale and for carrying out certain decontamination and deactivation duties when there is a relatively high probability of damage by war gases and radioactive substances.

Protective clothing includes: a light protective uniform, protective coveralls, and a protective uniform consisting of a jacket and pants. Protective clothing is made from rubberized fabric.

Figure 1c shows a soldier dressed in a light protective uniform. The length of time such a uniform is worn depends on the experience of the soldier and the temperature of the surrounding air, and may last several hours.

The protective apron is used for deactivation and decontamination of armament, combat equipment, and means of transportation. It is made from rubberized fabric and is used together with protective stockings and gloves.

Rules for the storing and care of individual means of protection. It is necessary to keep a constant check on the condition and working order of the protective equipment which is distributed; one must maintain the protective equipment in complete combat readiness and individually correct minor faults.

Under all conditions it is necessary to carefully protect the gas mask from blows, impacts, and violent shaking. Never dry or store it near a hot stove, radiator, or fire since this will ruin the rubber of the head mask and valves. Do not allow the gas mask to be kept in damp places; do not allow water to get into the cannister — this reduces its protective properties.

In cold weather, when the gas mask is carried into a warm place

it is necessary to wipe dry all of its components after sweating. When the head mask becomes dirty it should be washed with soap and water, wiped, and dried.

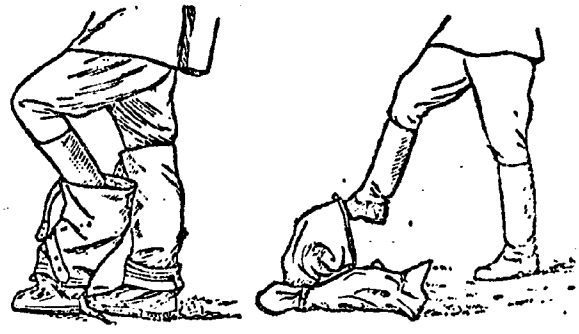


Fig. 7. Removing the protective stockings.

Particular attention must be paid to the breathing valve of the gas mask for even the slightest interruption in its operation could be fatal. If the valve is obstructed or sticks, one should blow it out or wash it with water, having first removed it from the valve box.

When using skin-protection equipment, it must have no holes in it; the protective cloaks, stockings, and gloves, and clothing should not have any punctures or slight tears; the protective stockings should have laces and straps.

Collective Means of Protection

Individual means of protection safely protect against radioactive substances and war gases, but their use is not always desirable.

or possible, especially for long periods of time. Therefore in a number of cases, for the protection of personnel against the effect of radioactive substances and war gases, collective means of protection will be used.

Collective means of protection include, mainly, shelters which are anti-nuclear and anti-chemically outfitted. The anti-chemical outfitting of such a shelter (Fig. 8) includes: air-tightness, installation of ventilation-filtration units, and the setting up of entrance chambers. The presence of a ventilation-filtration installation in shelters allows personnel to remain in them for long periods of time without individual means of protection.

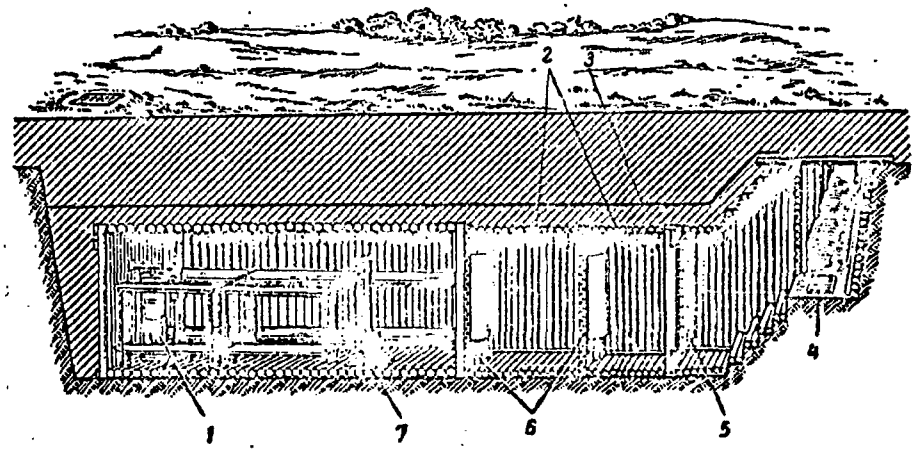


Fig. 8. Simple shelter which is anti-chemically outfitted: 1) ventilation-filtration set-up; 2) chambers; 3) water-proof layer; 4) water catch pit; 5) protective door; 6) air-tight bulkheads; 7) stove.

Besides vented shelters, there are also non-vented shelters.

These include recesses under parapets, dug-outs, basements, etc., which are antichemically outfitted. The outfitting consists of careful closing of all slits and holes through which the contaminated air could pass and of setting up air-tight doors or curtains which seal the entrance.

It is possible to stay in a non-vented shelter for only a limited time, i.e., until there is insufficient air for breathing. One must not enter such a shelter if the outside air is contaminated.

Personnel may remain in anti-chemically outfitted shelters (vented, non-vented) during enemy use of war gases and during the fallout of radioactive dust from a nuclear explosion cloud; there the personnel can rest and eat. In such shelters, when the locale is contaminated, medical aid can be rendered to the wounded and those injured by war gases.

Covered portions of trenches and slit trenches also afford protection against contamination by liquid war gases at the moment of their use, and from radioactive substances when they fall from a nuclear explosion cloud, however, they do not provide protection against contaminated air. Therefore, under coverings in trenches and slit trenches one must wear a gas mask.

The examined structures not only protect against the effect of war gases and contamination by radioactive substances but, in addition, sharply decrease the dose of radioactive irradiation: trenches and slit trenches — 15 to 30 times, dugouts — 300 times and more. In shelters, including the simple types, the possibility of irradiation is practically nonexistent.

CHAPTER 3

RADIATION AND CHEMICAL RECONNAISSANCE

In order to take opportune steps for protection against radioactive substances and war gases it is necessary to detect the beginning of radioactive contamination and chemical attack by the enemy or establish the presence of contamination in combat areas and warn the troops of it. This is done by radiation and chemical reconnaissance which is conducted during all phases of combat activity—on the offensive, on the defensive, on the march, and in encampments.

Radiation and chemical reconnaissance is conducted either by observation from a single point or by direct examination of a locale with simultaneous verification of the presence of radioactive substances and war gases in the air and in the terrain by radiation and chemical reconnaissance devices.

Soldiers and sergeants are prepared ahead of time in their units for carrying out radiation and chemical reconnaissance in a sector.

Radiative and Chemical Reconnaissance by Observation

Radiation and chemical reconnaissance by observation is carried

out by observers selected by the unit commanders, and also by observation posts of all arms of the services and by chemical observation posts.

In order to successfully carry out radiation and chemical observation missions, each observer must know well the indications of radioactive contamination, of the beginning of the use of war gases by the enemy, and of the presence of war gases in the air and on the ground.

Radioactive contamination of terrain, as previously mentioned, can occur mainly during surface nuclear explosions. Therefore, one must know how to distinguish surface nuclear explosions from atmospheric explosions. With a surface explosion the luminous region of the explosion has hemispherical form or the form of a truncated sphere in direct contact with the earth's surface; but in an atmospheric explosion, it has the form of a sphere above the earth's surface. The presence of a space between the explosion cloud and the column of ascending dust in the first seconds of their formation is also an indication of an atmospheric explosion. With a surface explosion much soil and dust is attracted from the ground, which gives a dark coloration to the mushroom shape of the atomic explosion.

The direction of movement of the radioactive cloud from surface explosion can be clearly observed right up to the time of its dissipation.

An observer can determine the onset of a chemical attack by the following external signs. When chemical aerial bombs (Fig. 9a) and artillery projectiles (Fig. 9b) are used, they form characteristic gas or vapor clouds at the point of impact. These clouds can be white, gray, yellow or green; spreading with the wind, they combine and become invisible. The sound of the explosions of chemical bombs,

projectiles, and mines are muffled and weaker than the sound of the explosions of ordinary ammunition.

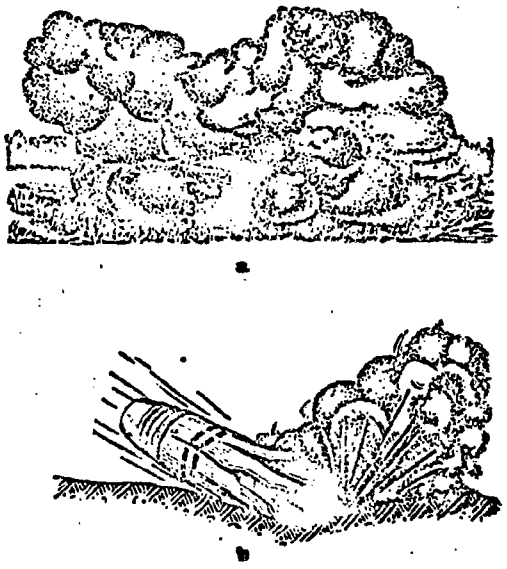


Fig. 9. Clouds from the explosion of a chemical shell: a) a chemical aerial bomb; b) a chemical artillery projectile.

With the explosion of aerial bombs and artillery projectiles (mines), which are armed with persistent war gases, oily drops and dark brown spots and smears will be noticeable in and around the craters.

If an aerial chemical attack is conducted by aerial decantation devices, then behind the aircraft there appear dark bands which rapidly descend and disperse (Fig. 10). The war gases in this case settle in the form of drop onto the region and local objects.

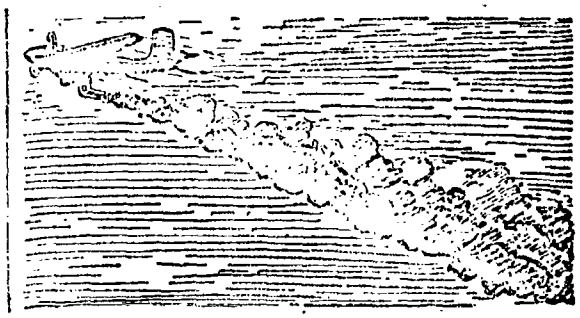


Fig. 10. The use of war gases by means of aerial decantation devices.

The observer may be in a locale in which the enemy has previously used a chemical weapon, in particular persistant war gases. In this case it is easy to notice the change in color of vegetation or its complete wilting, the presence of dark oily spots on the ground, snow, or local objects, and the sensing of a peculiar odor which is not natural to that locale.

The unit observer for radiation and chemical reconnaissance is situated in a place designated by his commander, is camouflaged, and constructs an overhang for protection against radioactive substances and war gases; the radiation and chemical reconnaissance devices are arranged so that they can be used conveniently. With nothing to distract him, he conducts observation of the enemy, of the terrain in front of him, and of the region where troop units are located.

During radioactive contamination or chemical attack, the observer does not cease his observations. He visually determines the regions of the unit which are subject to radioactive contamination or

chemical attack; he determines by which means and from which regions or from what directions the war gases are being used, and in what direction the contaminated air is being propagated. In the region in which he is located the observer by means of certain instruments determines the presence and type of radioactive substances and war gases.

If the observer does not have radiation and chemical reconnaissance instruments, he has fewer duties: to opportunely discover according to external signs the onset of radioactive contamination or chemical attack; to determine the positions of the unit against which the attack is made; to observe the direction in which the radioactive cloud is moving.

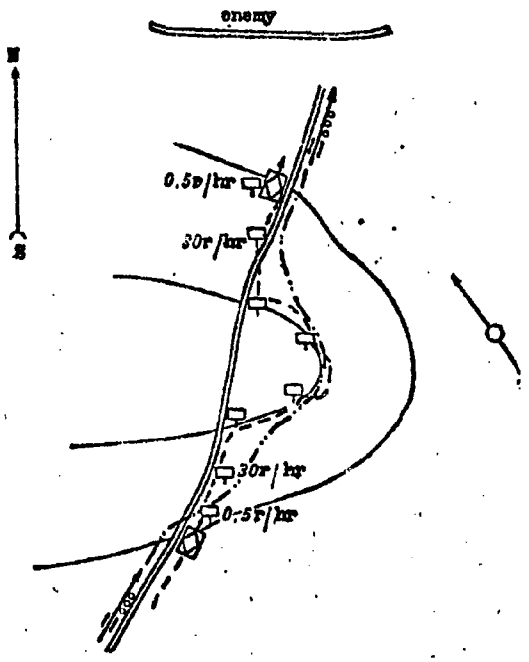
With the first signs of the presence of radioactive substances and war gases in his region the observer puts on his gas mask and other necessary means of protection.

Having discovered indications of radioactive contamination and chemical attack, the observer quickly reports to the commander and on his command gives the warning signal. If, however, the observer has detected the presence of radioactive materials and war gases by means of instruments, he first gives the warning signal and then reports to the commander.

Radiation and Chemical Reconnaissance by Examination of a Locale

Radiation and chemical reconnaissance by examination of a locale is carried out by special chemical reconnaissance patrols (CRP) and by reconnaissance units of all branches. Chemical reconnaissance patrols and reconnaissance units must be prepared to discover parts of the terrain contaminated by radioactive substances and war gases, to designate the boundaries of contamination, to locate and designate

a by-pass route and direction for favorably overcoming the contaminated sectors, and also to determine the radiation level and types of war gases used.



Legend

---- CRP route; — •• — troop route

Fig. 11. Operations of a chemical reconnaissance patrol in an armored personnel carrier during reconnaissance of a sector of the terrain contaminated by radioactive substances.

The reconnaissance of a sector of radioactive contamination (Fig. 11) is usually carried out by the chemical reconnaissance patrol in an armored personnel carrier. Moving towards the contaminated sector, the scouts carefully observe the readings of the roentgenometer; upon reaching a contamination boundary with radiation equal to 0.5 r/hr they set up a warning sign, having selected the

most discernible place for it. Then, continuing to move, the patrol reaches the boundary at which the radiation level corresponds to the limit indicated in the reconnaissance orders (e.g., 30 r/hr); a warning sign is also placed here. After this the patrol changes direction moving slightly to the right (or left) so as to travel over the terrain where the radiation level is at the reconnaissance limit; along the route warning signs are set out in obvious places. If the radiation level falls, then the patrol goes to the left (or to the right) and moves out to the route assigned to it. Having established and designated the rear boundaries of a contaminated section with a radiation level of 0.5 r/hr, the patrol moves out of the contaminated sector.

A chemical reconnaissance patrol first discovers war gases in a locale by external indications; then it precisely defines the contamination section by means of a chemical reconnaissance instrument. During reconnaissance of a sector contaminated by war gases, the chemical reconnaissance patrol can operate on foot. In this case the patrol should consist of a minimum of three persons.

The patrol carries out reconnaissance of a contaminated sector of the terrain on foot in approximately the following manner (Fig. 12). One scout moves in the primary direction, determining and designating the forward and rear boundaries. The other two scouts move to the right and left of the guide; they designate the forward boundary, determine the by-pass route, and then proceed to the rear boundary and designate it. The rest of the scouts (if there are more than three in the patrol) act according to the order of the patrol leader. When coming out of the contaminated sector, the patrol members rendezvous and report the results of the reconnaissance to the patrol leader.

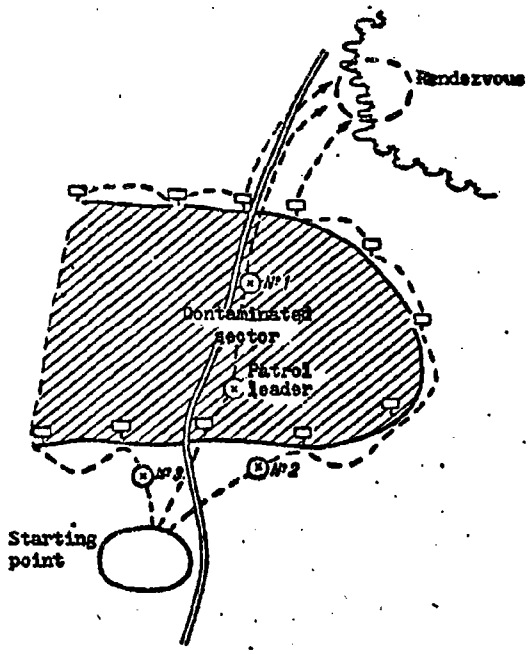


Fig. 12. The order of reconnaissance of a contaminated sector of the terrain by a chemical reconnaissance patrol on foot.

During reconnaissance of a sector of terrain contaminated by war gases it is necessary to take into account wind direction. If the wind is from the contaminated sector, then the smell of the war gas will be evident at a significant distance from the front boundary of contamination. With the wind blowing towards the contaminated sector, the smell can be detected only when directly approaching the sector.

Reconnaissance units reconnoitering the enemy can determine his preparation for the use of chemical weapon. From an examination, of artillery projectiles and mines for example, knowing their

identification symbol, it is possible to establish whether any of them are chemical weapons. Particular attention is paid to vehicles and devices having tanks, conduit systems, or sprayers; such machines and devices may be intended for the use of war gases. Near these there will usually be soldiers in individual means of protection.

While examining defense positions previously occupied by the enemy, and also the equipment of wounded and captured personnel, reconnaissance scouts should confiscate samples of means of protection against radioactive substances and war gases. In defense structures, particular attention should be paid to the presence of ventilation-filtration units. Samples of means of protection and the ventilation-filtration units can be used to evaluate the enemy preparation for chemical attack.

Warning Signals for Radioactive Contamination and Chemical Attack and Warning Signs for the Contaminated Sector

During the use of chemical weapons by the enemy, during fallout of radioactive substances from a nuclear explosion cloud, and also when encountering sectors of the terrain contaminated by radioactive substances and war gases, a pre-established warning signal is given. This signal can be conveyed by telephone, radio, siren, voice, or flare, or by improvised means: striking a cartridge case, rail or bell.

To prevent personnel from entering an area contaminated by radioactive substances and war gases, and also to designate through-routes and by-pass routes for contaminated sectors, standard-issue warning signs are used (Fig. 13). If no standard-issue signs are

available, the boundaries of contaminated sectors can be designed by various improvised means.

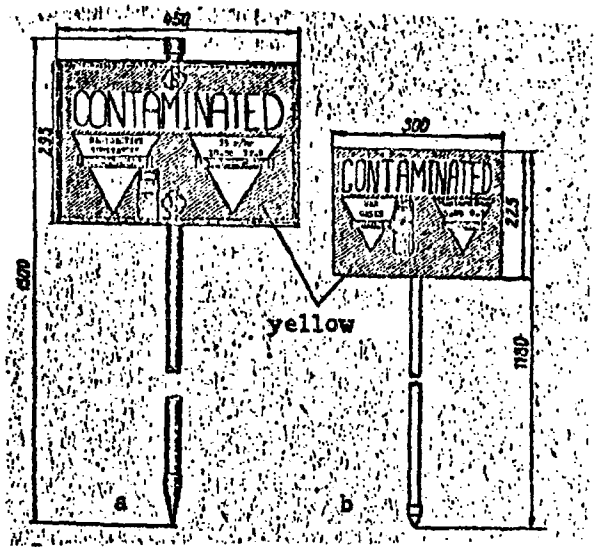


Fig. 13. Warning signs for contaminated sectors of terrain: a) sign carried by vehicle; b) hand-carried sign. (The dimensions of the signs are given in millimeters.)

When one hears a warning signal concerning radioactive contamination (chemical attack) or when one encounters signs indicating contaminated sectors, as quickly as possible one must put on his gas mask and, if necessary, the means for protecting the skin (protective stockings, protective gloves, etc.) and proceed to carry out his combat mission.

CHAPTER 4

SANITARY TREATMENT

Personnel exposed to contamination by radioactive substances or war gases must go through a so-called sanitary treatment.

Sanitary treatment is the removal of radioactive substances or war gases which have fallen on the skin. Depending on the situations, and with time and the available materials, the sanitary treatment can be carried out partially or completely and is classified as partial or complete treatment, respectively.

Partial sanitary treatment is carried out in a unit directly by the individual himself at the first possibility without neglecting his combat duty. It can be done after coming out of a contaminated area or in a contaminated sector.

Partial Sanitary Treatment During Contamination By Radioactive Substances

With contamination by radioactive substances, partial sanitary treatment is accomplished by removing radioactive substances from exposed parts of the body and from mucous membranes of the eyes, nose and oral cavity.

Outside of the contaminated sector, partial sanitary treatment is carried out in the following sequence. The first step is to remove the protective cloak and, while still wearing the gas mask, protective stockings, and gloves, remove the radioactive dust from equipment, wipe the outside of the facepiece of the gas mask, and deactivate the armament and military equipment. Next, take off the means of protection, deactivate them, wash the hands, and wash 2 or 3 times the exposed parts of the body with noncontaminated water, paying particular attention to thoroughly washing out and removing dirt from under the nails. Then thoroughly wash the nose out with clean water and rinse the mouth.

If there is a shortage of water, wipe the exposed parts of the body with a moist towel or pad moistened with water from a canteen. If no towel is available, use a handkerchief or some other available clean damp cloth. If there is no water whatsoever, the pads should be moistened with the liquid from the individual anti-gas pack. In extreme cases the exposed parts of the body should be wiped with dry pads, towels, or any handy noncontaminated materials (grass, leaves, paper); in the winter snow can be used if it is not contaminated.

In a contaminated sector, partial sanitary treatment is carried out only during prolonged operations in that region. Individual means of protection are not removed and the radioactive substances are removed only from the unprotected parts of the body. If the personnel are in a contaminated region without means of protection, it is necessary to wash or wipe the exposed parts of the body and then put on the means of protection.

In case that it is necessary to deactivate weapons or positions,

after such action it is again necessary to wash or wipe the exposed parts of the body with a moistened pad to remove radioactive substances which may have gotten on the body during deactivation.

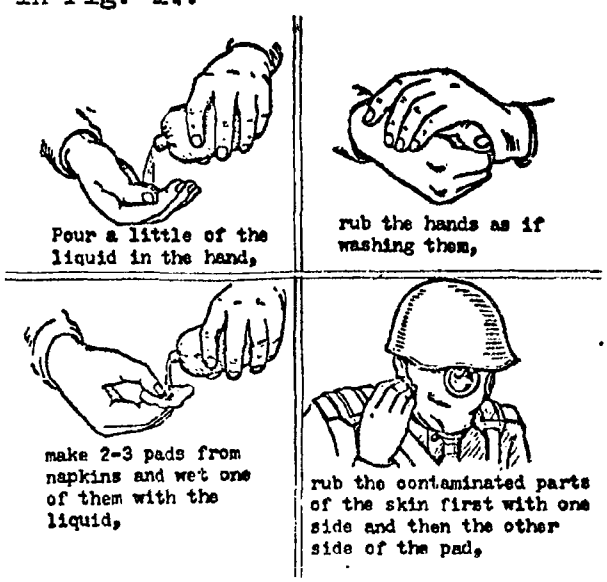
Partial Sanitary Treatment During Contamination By War Gases

With contamination by war gases, partial sanitary treatment is carried out by using the individual anti-chemical pack with which the contaminated skin of the body can be treated and contaminated parts of clothing and equipment can be decontaminated.

There are two types of individual anti-chemical packs: with one and with two decontamination solutions.

The individual anti-chemical pack with one decontamination solution is usually in the form of a bottle filled with decontamination solution, in a gauze bag.

Sanitary treatment by means of the pack with one decontamination solution is shown in Fig. 14.



and then once again treat the contaminated skin with another pad.

Fig. 14. Treatment of skin contaminated by war gases using the individual anti-chemical pack with one solution.

The individual anti-chemical pack with two solutions (Fig. 15) consists of a case in which there are a small and a large container with decontamination solutions, four ampoules with an anti-smoke mixture, and four gauze pads. The decontamination solution in the small container is intended for decontamination of war gases of the sarin type; that in the large container is for decontamination of war gases of the mustard-gas type.

When carrying out sanitary treatment using this pack, observe the following procedure. Open the pack and take out the small container. Make 3-4 punctures in the lower part of the container with the opener located in the cover of the case and, having squeezed the decontamination solution from the container, wet one gauze pad with it. Rub the exposed parts of the body with the pad for 1.5 to 2 minutes. Then wet the exposed parts of the clothing with the solution from the small container and rub them several times with the gauze covering of the container. Then take the large container from the case, break the glass ampoules located in it, shake the container 10-15 times, puncture it with the opener, and treat the contaminated parts in the same way as with the solution from the small container.

When treating the skin with moistened pads, it is recommended before use that they be squeezed slightly so that the decontamination solution does not spread beyond the contaminated parts and when wiping the face it does not get in the eyes.

When treating clothing, the contaminated parts are moistened with the decontamination solutions until the solution soaks into the skin, i.e., until wetness is felt on the body.

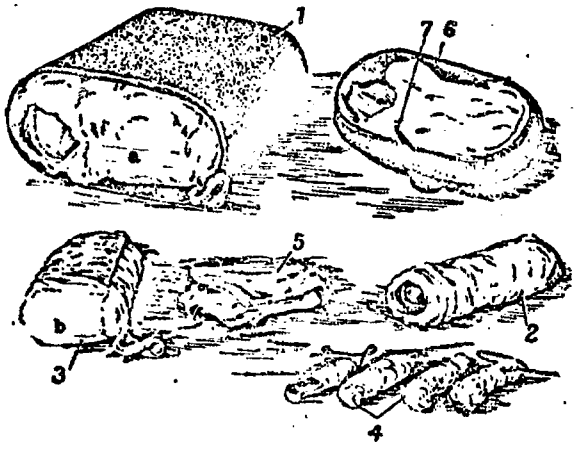


Fig. 15. Individual anti-chemical pack containing two solutions: 1) case; 2) small container; 3) large container; 4) ampoules with anti-smoke mixture; 5) gauze pads; 6) case cover; 7) opener for puncturing the containers. a and b) do not open.

Partial sanitary treatment in the case of contamination by war gases must be conducted immediately after contamination, having reported first to the commander. The parts of the skin and clothing which cannot be treated by the soldiers themselves (back, shoulders, back of the head) are treated with the help of a comrade.

Complete Sanitary Treatment

Partial sanitary treatment does not give complete guarantees against disease. Therefore, as soon as the combat situation allows, complete sanitary treatment is conducted.

Complete sanitary treatment includes careful washing of the body, as a rule, with hot water and soap usually under a shower at

a special sanitation point. In the summer, sanitary treatment can be conducted in uncontaminated water (river, lake).

Complete sanitary treatment is conducted after the person has completed deactivation (decontamination) of his weapon and equipment. In the case of serious contamination of a soldier, complete sanitary treatment should be conducted before deactivation (decontamination) of equipment.

After complete sanitary treatment of soldiers contaminated by radioactive substances, a radiation check is conducted.

CHAPTER 5

DEACTIVATION AND DECONTAMINATION

Weapons, equipment, and terrain contaminated by radioactive substances or war gases can be a source of danger to personnel. To avoid this, such objects are deactivated and decontaminated.

The elimination of radioactive substances from contaminated surfaces to a permissible degree of contamination is called deactivation. It is conducted by washing or sweeping the radioactive substances from the contaminated objects or removing the upper contaminated layer.

The rendering harmless of liquid drops of war gases or removing them from contaminated surfaces is called decontamination. It is conducted, as a rule, by chemical methods; as a result of the reaction between war gases and the decontamination substances, the gases become harmless products.

Removal of war gases from the surfaces of weapons is also possible by means of solvents (kerosene, gasoline), but in this case the gases are not eliminated but merely dissolved into the solvent, contaminating it.

Deactivation and Decontamination of Arms and Equipment

The deactivation and decontamination of arms, equipment, and vehicles, depending on the combat situation and the time available can be conducted partially or completely.

Partial deactivation and decontamination of weapons, equipment, and vehicles is conducted immediately, by the personnel assigned to them, in military formations using the table-of-allowance or available means. With partial treatment, those parts of weapons and equipment with which the service personnel come into direct contact during combat are deactivated and decontaminated.

Complete deactivation and decontamination of weapons equipment is carried out in an uncontaminated region after completion of the combat missions: either in the unit, using table-of-allowance means, or at a special treatment point. It includes the careful treatment of the entire surface of the weapons and equipment by deactivation and decontamination solutions.

In the case of the simultaneous contamination of weapons and equipment by radioactive substances and war gases, carry out decontamination first and then, after a radiation check, carry out deactivation if necessary. This treatment sequence is explained, first, by the fact that the effect of war gases is more dangerous to the human organism than is the effect of radioactive substances, and second, by the fact that decontamination at the beginning simultaneously washes off radioactive substances from the contaminated surface, i.e., it deactivates it.

For deactivation of weapons and equipment, water (in the summer) and aqueous deactivation solutions are used. When these are not available the following solutions may be used: dichloroethane,

gasoline, kerosene, diesel fuel, alcohol, and, in an extreme case, decontamination solution No. 2 contained in the decontamination kits.

Depending on the time of the year, summer deactivation or winter deactivation solutions are used. Deactivation solutions are foamy and wash away (take hold of) the radioactive dust deposited on the contaminated surface.

Decontamination solution No. 1 serves for the decontamination of weapons and equipment contaminated by war gases of the mustard-gas type. Decontamination of these same objects, contaminated by war gases of the TABUN type, is accomplished using decontamination solution No. 2.

When deactivation and decontamination solutions are not available for removing radioactive substances and war gases from contaminated surfaces, various solvents and available means (grass, straw, paper, dirt, snow) can be used.

Deactivation and decontamination of the carbine and submachine gun (Fig. 16). The carbine and submachine gun are usually treated completely. Only seldom is a partial treatment required of those parts with which one comes in contact during firing.

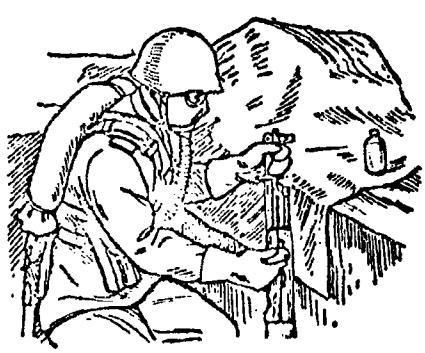


Fig. 16. Decontamination of a carbine.

Deactivation of a carbine (submachine gun) is conducted in the following manner. The weapon is placed in a vertical or sloping position and the surface is cleaned of all dust and dirt. Then 3-5 pads are made from uncontaminated packing or rags; these are thoroughly soaked with water, deactivation solution or a solvent, and the surface of the weapon is carefully wiped 2-3 times. Rubbing is done from top to bottom; otherwise the solution will run down to the deactivated parts and contaminate them. As the pad becomes contaminated, it is turned with its clean side toward the surface being treated, or it is changed.

Decontamination of a carbine (submachine gun) is done by means of the individual decontamination (in extreme cases — deactivation) pack. In this case, without dismantling the weapon, first use a dry pad or cloth to remove the visible drops and blots of war gas on it and then, using pads moistened with decontamination solution, carefully wipe all parts from top to bottom without leaving any spaces. The metal parts are lightly moistened, while the wooden parts and the sling are more thoroughly wetted. Slots, grooves, and other places in which the war gas can remain should be particularly carefully treated.

After deactivation and decontamination, the weapons are dismantled, cleaned, and lubricated.

Deactivation and decontamination of the machine gun and mortar. Partial and complete decontamination and also partial deactivation of a machine gun and battalion mortar, as a rule, is conducted by means of the machine gun-mortar decontamination kit.

During partial treatment of a machine gun and mortar, those parts are rendered harmless with which the crew comes in direct

contact during firing; when treating, as an example, a heavy machine gun and an 82-mm mortar, the following are treated: for the machine gun – the butt plate, the reload handle, the rear sight, the receiver, the precision-sighting knob, the shaft, and the hand and grip stop bolts of the barrel and pivot: for the mortar – the sight, the traversing and elevating mechanisms, the anchor rings and handles of the base plate, and the coarse leveling mechanism.

Partial deactivation is carried out by the gun layer by means of two or three spongings with a rag or brush from the decontamination kit; these are soaked in water, solvent, or solution No. 2. For partially decontamination, the gun layer carefully removes with a dry rag the drops and blots of war gas, not spreading them; then he washes the contaminated places (Fig. 17), first with solution No. 1 and then with solution No. 2. The cartridge holders or the mortar chutes are decontaminated in the same manner. The remaining members of the crew decontaminate the entrenchment or the area.

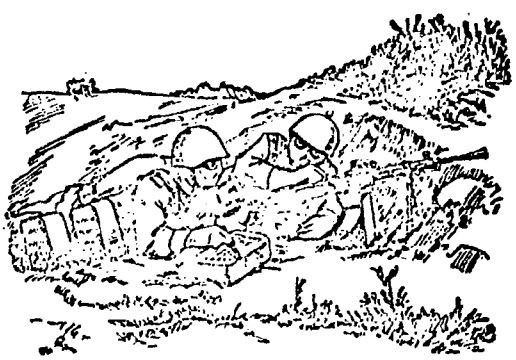


Fig. 17. Decontamination of a machine gun.

Complete deactivation and decontamination of a machine gun and mortar are conducted in the same manner as partial deactivation and decontamination, but in this case the radioactive substances and war gases are removed from the entire surface of the machine gun

and mortar; in addition, the machine gun and mortar are cleaned and lubricated.

Deactivation and decontamination of artillery pieces. Partial treatment of an artillery piece includes rendering harmless the parts of the artillery piece with which the crew comes in direct contact during firing, i.e., the sight (panorama), the traversing and elevating mechanisms, the breechblock, the trails (from the shield to the first little apron or to the in-travel stop lock), and the hand trails.

For decontamination of artillery pieces the individual or artillery decontamination kit is used; kits can also be used for partial deactivation of artillery pieces.

Partial deactivation of artillery pieces is conducted in the following manner. Using straw brooms, or bundles, branches, etc., sweep the radioactive dust from the artillery piece and then with a rag, fiber packing, brushes and pads moistened with water, solvent (kerosene, gasoline), or decontamination solution No. 2 wipe those parts of the artillery piece with which the crew comes in direct contact during battle.

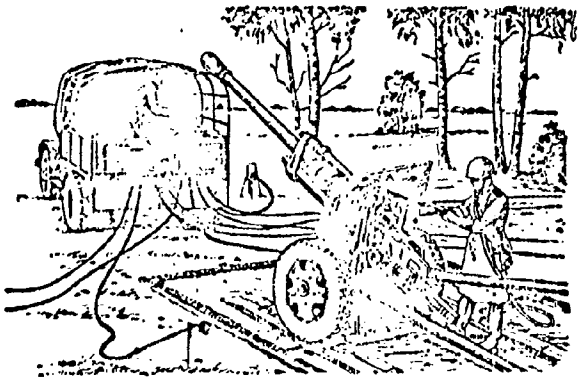


Fig. 18. Complete deactivation of an artillery piece by means of an ADM-48 automatic decontamination machine.

Complete deactivation of an artillery piece is done by washing it from the top to the bottom with streams of water from a pump, a motor-operated pump, or some other device having a pump hose with a brush (Fig. 18). In this case the artillery piece is not dismantled, but the gunner takes off the sight adjustment and treats it separately.

Partial decontamination of an artillery piece is done in the following order. The gunner decontaminates the sight adjustment, without removing it from the artillery piece. This is done with particular care in order not to damage the sight. During decontamination carefully remove by means of a dry cloth the drops and blots which have fallen on the sight; then the framework of the weapon (except for the glass of the eyepiece and the objective) is wiped three times with a rag moistened with gasoline or the solvent from the decontamination kit and, if available, with deactivation solution. After that the weapon is wiped with a rag moistened with decontamination solution No. 2; the liquid should not be allowed to flow into grooves or apertures.

After treatment, the device is wiped dry.

At the same time the first and second crew members decontaminate the remaining parts of the artillery piece; with packing material they carefully remove, not spreading, the drops of war gases from the parts of the artillery piece to be treated and wipe these parts with a bruch moistened first with solution No. 1 and then with solution No. 2.

Complete decontamination of an artillery piece is carried out in the following manner: two members of the crew, using a dry cloth, remove the drops and blots of war gases from the entire surface of

the artillery piece — one on the right, the other on the left side; two other members rub down the entire piece with solutions from the decontamination kit (Fig. 19).

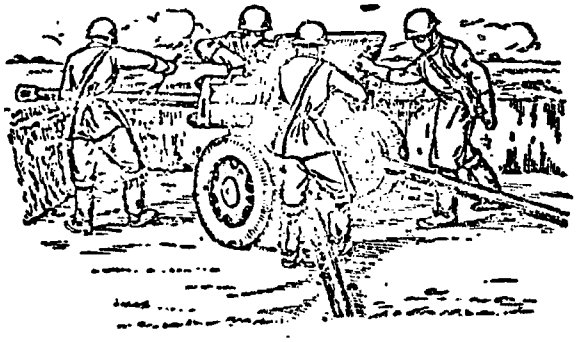


Fig. 19. Complete decontamination of an artillery piece by means of an A-DK artillery decontamination kit.

The sighting device is treated similar to its treatment during partial decontamination.

Deactivation and decontamination of a tank. During partial deactivation and decontamination of a tank, the turret, platform, hatch, armament, and instruments are treated; in addition, the insides of the tank — the surface of the fighting cab and driving cab, instruments, and driving controls are treated. Decontamination of the inside surfaces is carried out when drops of persistent war gas get inside the vehicle.

Partial deactivation of a tank is done using a broom or brush moistened with water, fuel from the fuel tank, or decontamination solution No. 2. For partial decontamination the decontamination solutions of the artillery decontamination kit (field-pack decontamination kit) or fuel from the fuel tank of the vehicle are used.

Decontamination using fuel is done by scrubbing two or three times the contaminated sections with a moistened broom, brush, or

scrub brush; after each scrubbing with the fuel, the decontaminated surface must be wiped dry.

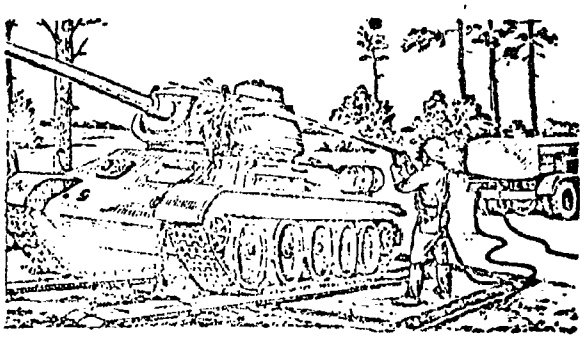


Fig. 20. Complete deactivation of a tank.

Complete deactivation of a tank is conducted by washing it down with streams of water from a pump, motor-operated pump or decontamination vehicle (Fig. 20). The front armor plate, turret, hatch, and site of the landing troops are most carefully treated. In order that water not get into the tank, before deactivation all the hatches are tightly closed and the louvers are covered with canvas.

Complete decontamination of a tank in the unit is usually accomplished with the field-pack decontamination equipment by spraying from top to bottom with decontamination solutions, or by hand with a broom or brush made from available materials. At the special treatment point the complete decontamination of a tank is accomplished by means of decontamination machines.

Self-propelled artillery, armored personnel carriers, trucks and special vehicles, prime movers, and tractors are deactivated and decontaminated in the same way as for tanks. Vehicles during partial deactivation and decontamination are treated at the points shown in Fig. 21.

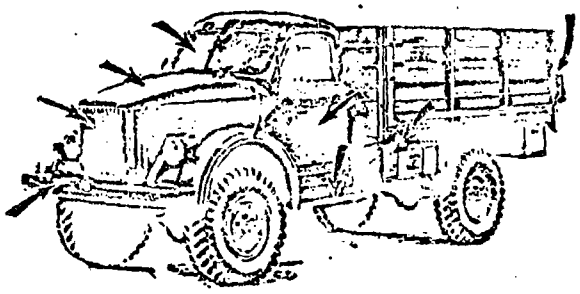


Fig. 21. Parts of a vehicle to be treated during partial decontamination and deactivation.

Deactivation and Decontamination of Positions and Terrain

When necessary to render harmless positions and terrain contaminated by radioactive substances and war gases, they are deactivated and decontaminated; this is done by the units themselves.

Trenches, communication trenches, and entrenchments with sloping revetments are deactivated, without disturbing the camouflage, in the following manner. Three-four centimeters of soil are scraped from the berm and thrown behind the parapet; after this the slopes of the trench (entrenchment) are swept with a moistened broom or switches made of hay or grass. Then 3-4 cm of soil are removed from the bottom of the entrenchment (trench) and carried to a specially excavated pit. The bare slopes are cleaned with a shovel, removing a layer of 3-4 cm of soil.

Decontamination of trenches, communication trenches, and entrenchments is accomplished by removing a 3-4 cm layer of soil. The sloping revetments are decontaminated using an aqueous paste of bleaching powder or decontamination solutions.

Deactivation of a contaminated terrain includes the removal of radioactive substances from the surface, covering this surface with

an uncontaminated layer of dirt, or laying down different ground coverings. Because of the laborious work of this operation, only passes and the locations of materiel and personnel are deactivated. On soft ground the upper layer of soil is removed with shovels; if conditions permit, units with graders, scrapers, and bulldozers are recruited. The removal of radioactive substances from solid coverings can be accomplished by sweeping the dust or washing it off with water using spray-washing vehicles.

Decontamination of passes and terrain is done by special machines using decontamination substances.

Safety Measures During Deactivation and Decontamination

All deactivation and decontamination work is carried out using individual means of protection: for weaponry — the gas mask, protective stockings, and gloves; artillery pieces (mortars), military equipment, and means of transportion — gas mask, protective stockings, gloves, and apron; for the terrain — gas mask and protective clothing.

The means of protection are put on or removed only on order of the commander and in a place indicated by him.

When conducting deactivation and decontamination it is necessary to observe the following requirements:

- damage or serious contamination of the means of protection is quickly reported to the commander;
- do not place deactivation and decontamination materials on contaminated areas or objects;
- used wiping materials are thrown into holes and, after completing the operation, the hole is filled in;
- aviod unnecessary contact with contaminated objects;

- do not eat, drink, or smoke in a decontamination or deactivation area;
- do not touch uncovered parts of the body with contaminated protective gloves;
- do not raise dust or spray;
- after finishing the work carry out partial, and if necessary complete, sanitary treatment.

CHAPTER 6

DOSIMETRIC MONITORING

In order to determine the dose of radioactive irradiation of personnel and the degree of contamination by radioactive substances of people, clothing, equipment, armament, and material, so-called dosimetric monitoring is conducted.

Dosimetric monitoring is divided into irradiation monitoring and radioactive contamination monitoring.

Monitoring Irradiation

During operations in a locale contaminated by radioactive substances and while carrying out deactivation operations the unit commander must always know the irradiation dose the personnel have received in order to determine, on this basis, the danger to the health of personnel caused by the received radiation and if later the personnel can fulfill their combat mission in the contaminated section or if it is necessary to take measures which will prevent further harm to the personnel by radioactive radiation. This is accomplished by irradiation monitoring.

The monitoring of personnel irradiation is accomplished by means of dosimeters.

A dosimeter is an ionization chamber by means of which it is possible to reocrd radioactive radiation. The dosimeter resembles a fountain pen in looks, size, and shape (Fig. 22). It has a spring clip for conveniently attaching it to the pocket.

Fig. 22. Dosimeter (ionization chamber).

Fig. 23. Position of radiometer during measuring.

Before being distributed to personnel, the dosimeters are electrically charged to a specific voltage. As a result of the effect of gamma-rays on the dosimeter, its charge decreases in proportion to the radiation dose received by the person.

Unit commanders obtain charged dosimeters and distribute them to soldiers before entering a contaminated sector or before a deactivation operation. If the unit is operating under identical conditions in a contaminated locale, it is sufficient to distribute only several dosimeters to the unit; in this case the radiation dose of each soldier is determined by the average dose value of all dosimeters distributed to the unit. The unit commander lists the dosimeters in a radiation calculation log.

When emerging from a contaminated sector or when deactivation

has been completed, the dosimeters are turned in, the voltage drop in them is measured, and the irradiation doses which the personnel received are determined according to the voltage drop. The measurement results are recorded in the log.

Monitoring of Radioactive Contamination

Monitoring of the radioactive contamination of personnel, clothing, equipment, arms, and materiel is set up for the purpose of determining the degree of their contamination and the need for carrying out complete sanitary treatment and deactivation. This monitoring is accomplished by means of a special instrument — a beta-gamma-radiometer (Fig. 23).

Monitoring of radioactive contamination is conducted when the units emerge from a contaminated sector or when they carry out complete sanitary treatment or deactivation.

The monitoring of radioactive contamination of personnel, arms, and materiel taken from a contaminated sector is usually done selectively. For this purpose, dosimetry stations are set up in places determined by the commander. The monitoring of contamination can also be carried out by the unit chemical adviser equipped with a radiometer. On the basis of the monitoring data, a decision is made concerning the need for conducting sanitary treatment of personnel and the deactivation of arms, materiel, means of transportation, and stores.

Dosimetry specialists (chemists) located at a monitoring control station and in all personnel and materiel treatment areas measure the degree of radioactive contamination at a special treatment point. Depending on the degree of contamination determined at the

monitoring control station, the contaminated equipment is sent to a materiel deactivation area or, if the contamination is lower than the permissible norm, they are sent to a staging area. The degree of contamination in the regions of the special treatment point is measured for the purpose of determining the completeness of sanitary treatment and deactivation; if after treatment the contamination remains higher than the permissible, the persons and materiel are returned for repeated sanitary treatment and deactivation.

CHAPTER 7

OPERATIONS IN A LOCALE CONTAMINATED BY RADIOACTIVE SUBSTANCES AND WAR GASES

When nuclear and chemical weapons are being used, special endurance, stability, discipline, initiative, boldness, agility, decisiveness in action and an unswerving determination to be victorious over the enemy is required of each soldier.

Agility and decisiveness have particular significance: the more rapidly the troops approach the enemy, the less the danger of damage by nuclear and chemical weapons since under such conditions the enemy, in order not to harm his troops, will be reluctant to use such weapons.

The combat situation, however, may force units to operate for long periods in a locale contaminated by radioactive substances and war gases. Because of this the personnel must use means of protection.

The Effieicent Use of Means of Protection — A Major Condition for Successful Operations in a Contaminated Locale

There is no doubt that individual means of protection to some degree restrict movement, impair audibility and vision, and restricts

the intake of food and water. But all of these difficulties are successfully overcome by soldiers with high esprit de corps, who are physically tempered and hardy, and thoroughly trained in the efficient use of means of protection and can remain in them for long durations.

The ability to use perfectly the individual means of protection is one of the major conditions for successful operations in a contaminated locale. Each soldier must learn to fulfill his combat duties (to fire accurately, hike on foot or on skis, charge, make observations, etc.) in his means of protection with the same agility as without them.

Individual means of protection should be used opportunely in a minimally short time due to the fact that modern war gases are highly toxic: sometimes only one or two breaths of contaminated air are sufficient to have a fatal effect. Each soldier therefore should thoroughly know the warning signal for a chemical attack and should know his duties when this signal is given.

During use of non-persistent war gases by the enemy, the soldier, having put on the gas mask independently or at the signal (command), continues to carry out the assigned mission. During use of persistent war gases by the enemy and with precipitation of radioactive dust, besides the gas mask, means of skin protection are put on: protective coat (cloak), protective stockings, and gloves. To put on the means of skin protection, if the situation permits, one may take cover under overhangs, covered parts of trenches, communication trenches, or shelters.

No matter what the conditions of the enemy use of war gases or of radioactive contamination of a locale, a soldier must not

abandon his position or cease to carry out his duties. A charge of contaminated positions or exit from contaminated areas can be done only by permission of the commander.

The passage of personnel through trenches and communication trenches under conditions of a contaminated terrain is restricted, but if necessary it must be done wearing means of skin protection. Thus contact with slopes of trenches and communication trenches which may be contaminated can be avoided.

In the event it is necessary to dig in a contaminated sector, it is necessary, lying on the protective cloak, to first remove a layer of dirt 8-10 cm deep from the entire area of the trench and then continue to excavate in the usual manner.

In a defensive position, under the prolonged influence of radioactive substance and war gases, the use of engineering installations is very significant: covered sections of trenches, communication trenches, and dug-outs and shelters beneath parapets, equipped for protection against radioactive substances and war gases.

The unit commander determines the manner of using shelters and it must be made known to every soldier. On entering a shelter and emerging from it a certain amount of war gas penetrates into the shelter; in order to decrease this it is necessary to clean the boots before entering, shake the uniform to remove the war gas which has settled on it, and remove the protective cloak and stockings. In the covered part of a communication trench (before entering the chamber) one should remove the outer uniform (coat and sheepskin liner) and helmet, since was gases in the contaminated air was absorbed (settled) by them. Only two or three persons may enter the chamber at the same time; in each chamber they must wait

approximately 5 minutes. Both doors of the chamber must not be opened simultaneously. The next group enters the chamber after the preceding group has left and closed the door behind them.

A person is assigned to duty at the entrance to the shelter to strictly enforce these rules.

In a contaminated area, injury can be sustained by war gases if for some reason the soldier does not succeed in good time in making use of means of protection. In this case necessary aid should be quickly rendered to the injured person. The methods of rendering aid depend on the properties of the war gas, the combat situation, the condition of the injured person, and the type of wound. However, in all cases it is necessary to immediately put a gas mask on the victim to prevent further effects of the war gas on him.

When drops of sarin, TABUN, mustard gas, and lewisite get on the skin and clothing it is necessary to treat the contaminated place as quickly as possible with the individual anti-chemical pack; if a pack is not available, remove the war gas with a dry cloth, wash off the contaminated area with water, or take off the uniform. Wash the eyes and rinse the mouth with a 2% solution of drinking soda or pure water.

With contamination by prussic acid, one should have the injured person inhale the contents of an ampoule with an antidote; break the ampoule and insert it under the head mask of the gas mask. In clear air remove the gas mask from the victim, loosen the clothing, and, if necessary, administer artificial respiration. The injured person should be kept warm, and evacuated as quickly as possible to a field medical station.

In the event that radioactive substances get on the skin and uniform, measures are taken to wash them from the skin and remove them (most often by shaking) from the uniform.

The victim is evacuated to a field medical station only with permission from the commander regardless of the degree of injury by war gases or radioactive substances.

Besides protection of personnel, great attention should be paid also to protection of weapons, materiel, food supplies, water supply sources, and various supplies against war gases and radioactive substances. Always remember that it is easier to protect these from contamination than to conduct deactivation and decontamination. For the protection of weapons, materiels, food supplies, and means of transportation one uses various coverings, canvas, and all kinds of materials (branches of trees, straw, etc.); for water sources a thick covering is arranged. Personnel are forbidden to use food supplies in a contaminated area and uncovered water supplies unless they have been checked.

Overcoming Contaminated Sectors of a Region

Contaminated sectors are those sectors of a region in which there are radioactive substances or persistent war gases which make it necessary to operate in means of protection. In the case of contamination by radioactive substances, the locale is considered contaminated if the radiation level is 0.5 r/hour or higher.

Units encountering contaminated sectors should attempt to bypass them. However, this is not always possible and combat situation may compel units to pass through the contaminated sectors.

In the majority of cases, the contaminated sectors will be

overcome in vehicles, armored personnel carriers, or by conveyance on tanks and self-propelled artillery. At the same time it may be necessary to overcome contaminated sectors on foot when under enemy fire.

When overcoming contaminated sections on vehicles, armored personnel carriers, and by conveyance on tanks and self-propelled artillery, certain means of protection are used depending on the weather.

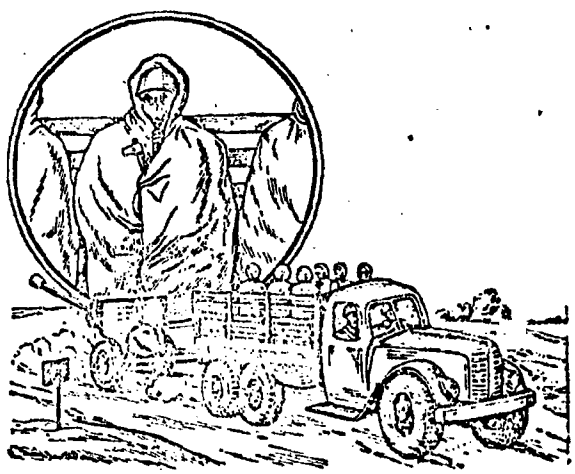


Fig. 24. Overcoming a contaminated sector of a region in a vehicle.

Radioactive dust will be the main danger when overcoming contaminated sectors in dry, windy weather, especially over traffic routes with loamy and sandy soil. Consequently, under these conditions in addition to protection of respiratory organs it is necessary to safeguard the exposed parts of the body and the uniform against contamination. For this purpose the personnel proceeding in vehicles (Fig. 24), armored personnel carriers and on tanks (Fig. 25) and self-propelled artillery, should put on: the mask, protective coat (protective cloak), and protective gloves. With expected dismounting in a contaminated sector, protective

stockings are also worn.

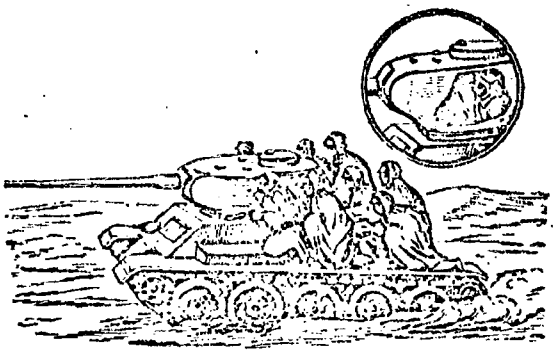


Fig. 25. Overcoming a contaminated sector of a region by conveyance on a tank.

The crews of tanks and self-propelled artillery and the drivers of vehicles overcome a contaminated sector in dry weather using gas masks. The hatches of tanks and self-propelled artillery and the windows in vehicle cabs are closed; the louvers of tanks and self-propelled artillery are covered or closed.

During damp weather, after rain, or during a snowfall (when there is no dust formation) personnel in vehicles and armored personnel carriers may pass through sectors of a region contaminated by radioactive substances without gas masks but using a protective coat (protective cloak) so that the dirt from the wheels does not get onto the uniform. Those conveyed on tanks and self-propelled artillery must operate in gas masks. Crews of tanks, self-propelled artillery mounts and drivers of vehicles and personnel carriers in this case overcome a contaminated sector without means of protection.

Those sectors of a region which are contaminated by war gases and sectors contaminated by both war gases and radioactive substances are overcome in the same manner and using the same means of protection as those sectors contaminated by radioactive substances

in dry weather.

The individual weapon, for overcoming contaminated sectors, is placed under the protective coat (protective cloak) to protect it against contamination by radioactive dust and lumps of dirt containing radioactive substances and war gases.

A contaminated sector is crossed at high speed in order to more rapidly emerge from the zone of contamination and in order that the personnel be exposed for the shortest possible time to radiation in the case of radioactive contamination and the effects of war gas vapors. The distances between vehicles increases to avoid spraying the vehicles in back with radioactive dust and avoid splattering with clumps of dirt contaminated by war gases and radioactive substances.

Overcoming contaminated sectors on foot. In all cases of overcoming a contaminated sector on foot one must not permit exposed parts of the body and clothing to become contaminated. For that purpose one should always have the means of protection in proper working order and know how to opportunely and correctly use them; during overcoming contaminated sectors, by-pass the obvious sources of contamination, thick grass, and underbrush, and use the natural features of the terrain which allow movement at full height; lie down in the contaminated sector only when forced to by the combat situation. The charges should be more prolonged and vigorous.

For overcoming a contaminated sector on foot, the gas mask, protective stockings, protective gloves, and protective coat or pad are used. Sectors contaminated by radioactive substances are overcome in damp weather without putting on a gas mask.

Let us examine the procedure of overcoming a contaminated sector using the protective pad.

The protective pad is prepared in a covered place before overcoming a contaminated sector. To do this, take the two sticks approximately 80 cm long and 1.5 to 2 cm in diameter and place them into the tubular folds of the pad; the edges of the protective pad are connected with straps. Then put on the protective stockings, gas mask, and protective gloves.

When overcoming a contaminated sector the protective pad is carried by both sticks, which have been placed into the tubular folds of the pad, in the left hand so that the lower part of the uncontaminated side of the pad is turned towards the left leg. The weapon is carried in the right hand.

It is necessary to lie down on the pad correctly in order to avoid contamination. To do this (Fig. 26), first take a half step forward with the left foot and drop the protective pad's lower edge to the ground so that its lower right corner is in front of the left foot; then take a half step forward with the right foot, place the protective pad on the ground, drop with the left knee to the lower edge of the pad and, resting on the left elbow, lie down on the left side. After that, assume the firing position.

To get up from the protective pad (Fig. 27) one must: turn on the left side and rest the rifle butt against the lower part of the protective pad; get up on the left knee having gripped with the left hand at the same time the lower stick in the tubular fold of the pad; place the right foot on the ground in line with the pad, stand up, lift up the protective pad, and continue the charge.

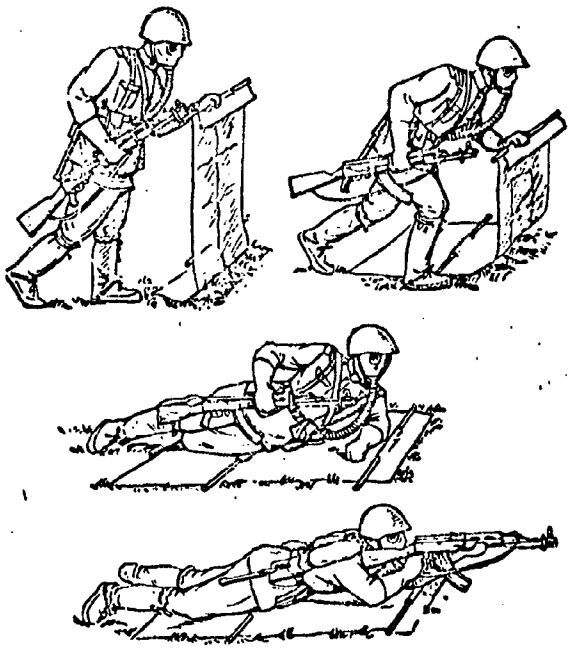


Fig. 26. Procedure for lying down on the protective pad when overcoming a contaminated sector of a region.

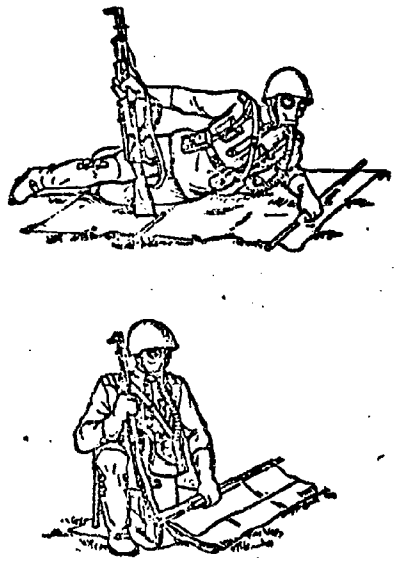


Fig. 27. Procedure of getting up from the protective pad.

Having overcome the contaminated sector, the personnel leave the protective pad behind and continue to carry out the combat mission. If conditions permit, partial sanitary treatment and partial deactivation and decontamination of the weapon are conducted.

In order to decrease enemy firing action to a minimum during overcoming a contaminated secotr, all the firepower must suppress the manpower and firing points of the enemy. For such purposes close cooperation is organized between the units overcoming the contaminated sector and the supporting artillery.

Certain Calculations Concerning Encampment in Sectors of a Region Which Are contaminated by Radioactive Substances

The duration of encampment in a region contaminated by radioactive substances is determined by the specific conditions which

comprise a combat situation. In the general case it is possible to determine the maximum possible time the personnel can remain in a contaminated sector by the following formula:

$$t = \frac{D}{R},$$

where t is the time of encampment in the contaminated sector, in hours; D is the dose of radiation, in roentgens; and R is the level of radiation in the contaminated sector, in roentgen/hour. Let us demonstrate this using the following examples.

Example 1. How long can a unit remain in a contaminated sector with levels of radiation of 20 r/hr so that the irradiation of personnel does not exceed the maximum permissible norm?

Solution. It is known that the maximum permissible norm of a single irradiation is 50 r. Thus:

$$t = \frac{D}{R} = \frac{50}{20} = 2.5 \text{ hours.}$$

Example 2. Unit personnel operating in contaminated sectors received an irradiation of 32 r. This unit was engaged in combat in the contaminated sector with a radiation level of 6 r/hour.

How long can the personnel remain in the contaminated sectors so that the total dose does not exceed the permissible limit?

Solution. We find the excess dose of radiation the unit can receive without exceeding the maximum permissible irradiation norm:

$$50 - 32 = 18 \text{ r.}$$

Let us determine the maximum possible time the unit can be encamped in the contaminated sector:

$$t = \frac{D}{R} = \frac{18}{6} = 3 \text{ hr.}$$

Using the formula presented above we can also calculate the dose of radiation received (knowing the encampment time in the contaminated sector and the level of radiation)

$$D = Rt$$

and the radiation level (knowing the encampment time in the contaminated sector and the dose of radiation received in that time)

$$R = \frac{D}{t}.$$

When overcoming a sector contaminated as a result of a nuclear explosion, the levels of radiation along the route will not be constant; they will change from low values up to a maximum and then back again. Therefore for purposes of calculations one should take the average value of the radiation levels, which can be approximated as:

$$R_{av} = \frac{R_{max}}{2}.$$

The time in which the contaminated sector can be overcome is determined from the formula

$$t = \frac{S}{V},$$

where S is the route in kilometers; and

V is the rate of movement in km/hr.

Substituting the values R_{av} and $\underline{t}$ into the formula $D = Rt$, we can write

$$D = \frac{R_{max} \cdot S}{2V}.$$

From the given formula it is obvious that when the values of the radiation level and the length of the route are identical, the radiation dose will be the lower, the faster the contaminated sector is overcome. Let us confirm this by the following example.

Example 3. The unit is to overcome a contaminated sector 2 km deep and with a level of radiation of 30 r/hr.

What radiation dose will the personnel receive while overcoming the sector at a rate of 4 and 8 km/hr?

Solution. Substituting the corresponding values into the formula which we just examined, we will obtain:

- for the case when the sector is overcome at a rate of 4 km/hr:

$$D_1 = \frac{30 \cdot 2}{2 \cdot 4} = 7.5 \text{ r};$$

- for the case when the secot is overcome at the rate of 8 km/hr:

$$D_2 = \frac{30 \cdot 2}{2 \cdot 8} = 3.75 \text{ r}.$$

Sectors of a region which are contaminated by radioactive substances will usually be overcome by vehicles, armored personnel carriers, or by conveyance on tanks or self-propelled artillery. The bodies of the vehicles diminish the effect of radioactive exposure to the personnel. For example, in a vehicle the radioactive exposure diminishes approximately by 2, in an armored personnel carrier by 4, and in a tank by 10.

These values 2, 4, and 10 are called the attenuation factor, which is designated by the letter A. Taking this factor into account, the formula for calculating the radiation dose takes the form

$$D = \frac{R_{max} \cdot S}{2\ AV}.$$

It is obvious from the formula that the radiation dose will be the lower, the higher the attenuation factor of personnel carriers and combat vehicles on which the personnel overcome a contaminated sector. This conclusion can be confirmed by solving the following example.

Example 4. The unit is to overcome a contaminated sector 10 km deep with a maximum radiation level of 80 r/hr. The rate of overcoming the sector is 20 km/hr.

What irradiation will the personnel receive when overcoming the sector in vehicles, armored personnel carriers, and tanks?

Solution. Having substituted the corresponding values into the formula we will obtain:

- for overcoming the sector in vehicles

$$D = \frac{80 \cdot 10}{2 \cdot 2 \cdot 20} = 10 \text{ r};$$

- for overcoming the sector in armored personnel carriers

$$D = \frac{80 \cdot 10}{2 \cdot 4 \cdot 20} = 5 \text{ r};$$

- for overcoming the sector in tanks

$$D = \frac{80 \cdot 10}{2 \cdot 10 \cdot 20} = 2 \text{ r}.$$

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