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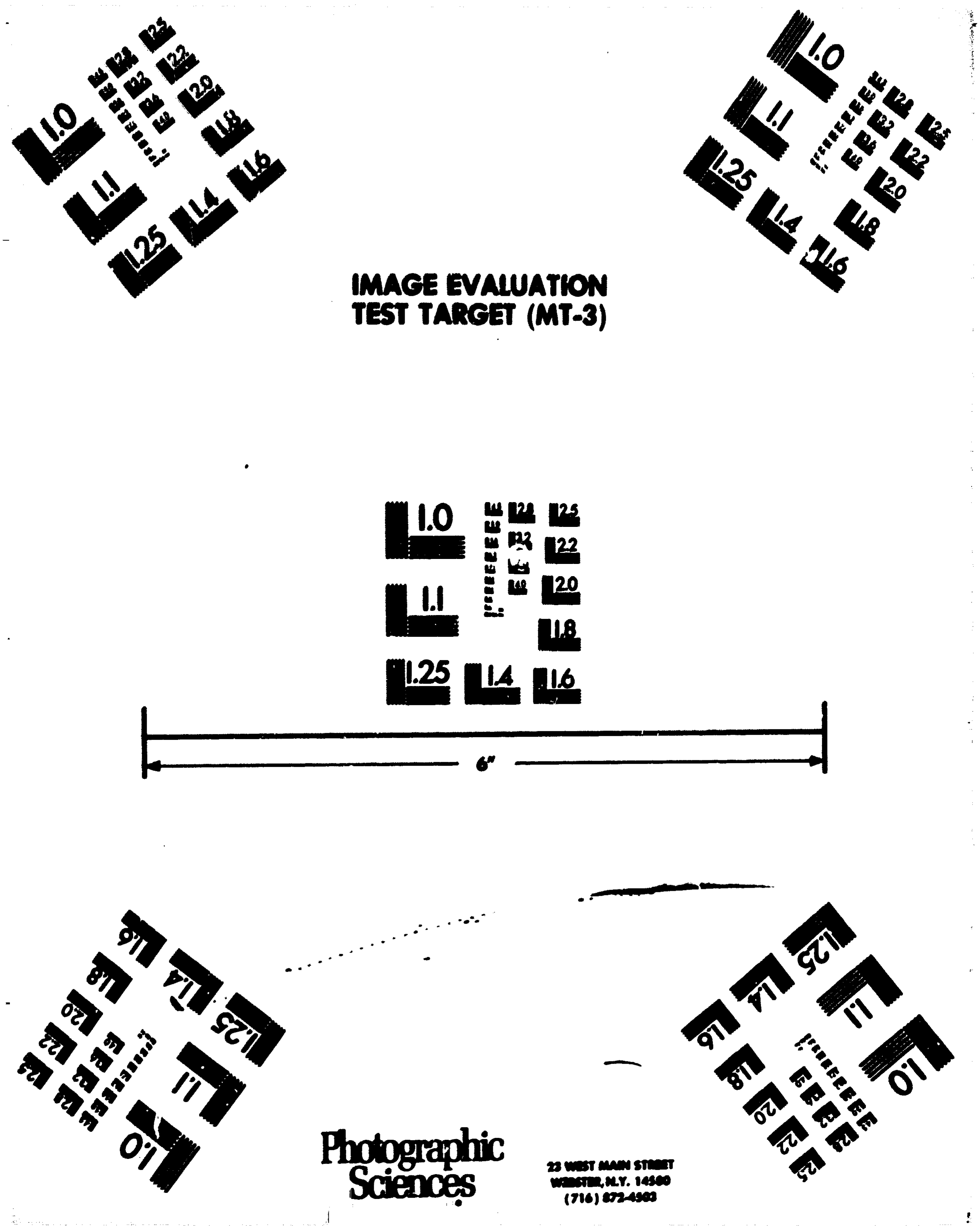
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USSR

# TRANSLATIONS ON USSR MILITARY AFFAIRS

(FOUO 10/79)

## Civil Defense at Agricultural Production Facilities

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# TRANSLATIONS ON USSR MILITARY AFFAIRS

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# CIVIL DEFENSE AT AGRICULTURAL PRODUCTION FACILITIES

Moscow GRAZHDANSKAYA OBORONA NA OB"YEKTAKH SEL'SKOKHOZYAYSTVENNOGO PROIZVODSTVA in Russian 1978 signed to press 13 Oct 77 pp 159-218, 331-335

[Annotation, Table of Contents and Chapter 7 from book by N.I. Akimov and V.G. Il'in, Izdatel'stvo "Kolos", 200,000 copies, 335 pages; title page information, table of contents, introduction and excerpts from book previously published in JPRS L/8260, 2 Feb 79, FOUO 4/79 of this series, pages 1-37]

Information on Authors

[Text] V. G. Il'in wrote chapters 2, 7 (except for the factors influenceing work stability at facilities and the basic measures for increasing work stability at facilities), 8, 9 and 11 of this book; A. M. Antropov and V. G. Kharin wrote chapter 12; N. I. Akimov wrote the rest.

Annotation

This textbook examines: CD tasks and organization at agricultural facilities; chemical, biological and radiation detectors and dosimeters; the facility CD plan; organizing and conducting rescue and emergency restoration work within the territory of an agricultural facility and also a contaminated urban facility; and other issues

Table of Contents

# CHAPTER 7. WORK STABILITY OF AGRICULTURAL FACILITIES IN WARTIME

## 1. Factors Influencing Work Stability at Facilities

[Text] One of the main missions of CD is increasing the work stability of national economic facilities during wartime, including agricultural facilities.

The problem of stable production of food and agricultural raw materials during a war is becoming one of the most important problems in the matter of supplying these materials to the Armed Forces, the population and industry. This causes a requirement to create, in peacetime, all the necessary prerequisites for normal functioning of agricultural production under the exceptionally difficult conditions of wartime and to thereby ensure the country a complete and uninterrupted supply of agricultural produce. V. I. Lenin wrote that "The best army and the people most devoted to the revolution will be immediately destroyed by the enemy if they are not sufficiently armed, supplied with food and trained."*

The facilities which, in peacetime, relatively realistically and precisely determine the factors which will have a negative effect on production and the facilities which develop the appropriate measures which must be conducted in peace and war will be better prepared for stable work during wartime. The timely conduct of organizational, agrochemical, agrotechnical, technical engineering and other measures can minimize the effects of weapons of mass destruction on agricultural facilities and

*Lenin, V. I. "Poln. sobr. soch-" [Complete Collected Works], vol 34, p 408.

they can create favorable conditions to quickly eliminate the aftereffects of an enemy attack and to restore their production activity. In this respect, by //work stability of an agricultural facility// during wartime, we mean its ability to quickly eliminate the effects of weapons of mass destruction and to restore production of the appropriate quality of agricultural produce at the planned level.

The basic calculations for evaluating the work stability of a facility primarily boil down to determining the possible losses in people, agricultural crops, agricultural livestock--including a reduction in their productivity--and also losses in other means of production. To make these calculations, it is necessary to have a knowledge of the factors which will effect the production process for agricultural produce.

The enemy's employment of nuclear weapons can have the largest effect on a facility. Because of this, it is very important: to determine the facility's location in relation to the probable site of a nuclear strike ahead of time; based on an evaluation of the probable situation, to anticipate which casualty producing factors can have an effect on the facility (which zone of radioactive contamination will the facility be located in); and also to estimate the possible production losses.

The effect of weapons of mass destruction on facilities can also be dependent upon their importance and area of specialization. Therefore, losses should be estimated with due regard for the area of specialization and the volume of agricultural production. Accordingly, it is necessary to plan and conduct measures which increase an agricultural facility's work stability. It is also important to take into account the seasonal nature of agricultural production. With comparatively similar effects from weapons of mass destruction, the work stability of agricultural facilities will depend upon the period of production these weapons are used in.

> For example, primarily winter crops can be destroyed during the winter; winter and spring crops can be destroyed during the spring; and the majority of the crops under cultivation can be destroyed during the summer. The largest losses will be when the enemy employs weapons of mass destruction during the spring-summer period. Plants are destroyed by radioactive irradiation to the greatest extent during the tilling phase and when putting out tubers.

By considering the factors which have an effect on the work stability of agricultural facilities and by using the appropriate methods, it is possible to determine their work stability under the variegated conditions of wartime and it is also possible to develop and conduct measures to increase the work stability of facilities.

2. Basic Measures for Increasing Work Stability at Facilities

The measures being conducted by the CPSU and the Soviet government--to introduce new technical equipment and new technologies into production on a widespread basis, to accelerate the development of agricultural machine building, to expand the power engineering capacities, to increase the output of mineral fertilizers and chemicals for protecting plants, to solve the protein problem, to increase the training of personnel and employees of the popular vocations, as well as other measures--are having a large, positive effect on the work stability of agricultural facilities.

To ensure stable work of an agricultural facility during a war, it is necessary--based on on-hand facilities--to develop, plan and conduct, in peace and in war, a system of measures directed at minimizing the effect of weapons of mass destruction on the facility and at creating favorable conditions to quickly eliminate the effects of an enemy attack.

In //peacetime//, primary attention should be devoted to creating and preparing a sufficient number of radiation shelters, stockpiling individual protective gear and medical supplies, and also training the entire population for efficient protection against the effects of weapons of mass destruction during an enemy attack and training them to conduct agricultural production. The more reliably the population is protected and the less the losses it takes, the more favorable the conditions will be for restoring stable work for the facility.

The following preparatory measures will be of great importance in ensuring the facility's work stability: stockpiling autonomous sources of electrical power and the necessary quantity of petroleum and lubricants; adapting agricultural equipment and maintaining it in good running order and in constant readiness for operation; creating the necessary stockpiles of materials to seal and reinforce the protective properties of residential, livestock, storage and other facilities and sources of water supplies and materials to protect (shelter) grain, feed, vegetables and other agricultural produce during its harvesting, transport, processing and storage.

It is always necessary to attempt to create the necessary stockpiles of produce, feed, biological preparations, antibodies, decontamination agents for livestock and plants, protective agents for plants, fertilizers and other materials. It is also necessary to stockpile those kinds of produce and feed which can be preserved for a long time--canned, frozen and sterilized produce and feed in granules, briquets and concentrated form. It is advisable to develop rabbit breeding, poultry breeding and fish breeding in every way possible since these sectors provide more produce with the least expenditures of labor and feed; in addition, poultry has a greater resistance to radioactive irradiation.

Creating good hygienic conditions for housing, feeding and using livestock, conducting disinfection and exterminating insects and rodents at farms on a regular basis and also planned immunization of livestock against infectious diseases are of great importance. It is necessary to supply highly valuable pedigreed livestock and highly productive livestock with the simplest individual protective gear for their respiratory organs and skin. It is recommended that protective masks be made at all farms in peacetime.

CD requirements should also be taken into account during future construction of new, standard livestock facilities and also when on-hand cattle pens, pigstys and poultry houses are being equipped and repaired. It is necessary, on a more widespread basis, to raise highly productive breeds of agricultural livestock which are most immune to different diseases and also high-yield agricultural corps which are immune to diseases and which resist pests. In growing plants, the development of irrigated cultivation and the timely and complete conduct of agrotechnical, agrochemical, land reclamation and other measures are of great importance in obtaining good, immune crops. It is necessary to introduce work automation and mechanization when breeding livestock, growing plants and processing raw materials; it is necessary to prepare and adapt agricultural equipment for use when eliminating the aftereffects of an enemy attack.

/A system of measures directed at increasing work stability of agricultural facilities in wartime./ After the enemy employs weapons of mass destruction, it is necessary to concentrate the primary efforts on: quickly eliminating the aftereffects of this attack, restoring stable work at the facility and efficiently conducting agricultural production on contaminated territory for the purpose of obtaining good quality agricultural produce at the planned level. It is primarily necessary to restore the lost resources.

When necessary, first-aid is rendered to the victims of the attack and personal cleansing is conducted. Missing manpower is replenished with uninjured people living on the facility's territory. It is necessary to ensure reliable protection against damage for the entire population during the production process. The people must strictly observe the established procedures for their conduct.

When the electrical power supply network is severed, measures are taken to restore it. In this case, it is necessary to connect the facility's autonomous electrical supply system and, when necessary, take the appropriate measures to restore the centralized supply of electrical power to the facility. It is especially important to conduct this measure in a clear-cut and timely manner at integrated poultry farms, poultry combines and livestock complexes where the production process can be completely interrupted without electrical power.

In restoring production activity, it is necessary to use the equipment remaining at the facility on a widespread basis (motor vehicles, tractors, agricultural machinery, etc.). Damaged machinery and equipment which can be reconditioned is reconditioned and used as assigned. When necessary, contaminated equipment undergoes specialized cleansing.

Special attention must be devoted to supplying the agricultural facility with petroleum and lubricants. The requirements for them are established by estimating all the work to be accomplished from the time of the enemy's employment of weapons of mass destruction up to the end of the year (tilling, putting down fertilizer, weeding, watering, harvesting, etc.). At the same time, the petroleum and lubricants remaining after the employment of weapons of mass destruction are taken into account; the appropriate requisitions are submitted to higher organizations for the deficit.

When necessary to eliminate the aftereffects of the enemy's employment of weapons of mass destruction and to restore stable work at the facility, measures are conducted to decontaminate the terrain, radiation shelters and the approaches to them, residential buildings, livestock, storage and other facilities, water sources, produce and feed. It is very important to restore and replenish the appropriate decontamination equipment, chemical agents for protecting plants and for veterinary cleansing of livestock and also stockpiles of fertilizer in a timely manner. When necessary, veterinary aid is rendered to contaminated livestock. In horticulutre, agrotechnical, agrochemical and other measures are conducted to preserve and grow corps with consideration for the special features of the soil on the facility's territory, types of plants, the season and climatic conditions.

[redacted]



The amount and nature of the measures to restore the facility's stable production activity will depend on the type and yield of the weapons employed by the enemy, on the degree of the effect of their casualty producing factors on individual sectors and on the facility as a whole, i.e., on the situation which develops at the facility.

If the facility is //in subzones A-1 and A-2 of the radioactive contamination//, then all the restrictions which were introduced under the CD alert "Danger of Radioactive Contamination!" are cancelled. There are no restrictions on the work time in all sectors of agricultural production. Livestock can be located on open land and feed is used without any restrictions. If the livestock have eaten contaminated feed, then the adult population is allowed to use the fresh milk on the third day in the first subzone and on the fifth day in the second subzone; children are allowed to use it on the 15th and 25th days, respectively. Livestock destined for slaughter undergo veterinary cleansing. The produce from all agriculutral crops can be used for nutritive purposes without any restrictions.

//In subzone A-3 of the radioactive contamination//, the populace must remain in radiation shelters for a 24-hour period. It is possible to leave them for 2-3 hours, 12 hours after the explosion. Adult livestock should be kept in closed facilities for a 24-hour period and young livestock for a 4-day period. Except for milkcows, it is permitted to put livestock out to pasture two days after the fallout and milkcows can be put out three days after. The milk obtained during the first six days must be processed; on the seventh day, adults can use it and children on the 25th day. Livestock can be slaughtered for meat only after veterinary cleansing. Except for the upper, contaminated layer, feed can be used without any restrictions. Except for wheat, it is permitted to use all agricultural crops as food on the second day after the radioactive fallout.

//In subzone A-4 of the radioactive contamination//, the populace must remain in radiation shelters while at the same time observing the established procedures, which can be cancelled after ten days have passed. Adult livestock must be kept in livestock facilities for the first two days and young livestock must be kept in for the first five days. The facilities in subzone A-4 are sealed for 1.5-2 hours. It is permitted to put the livestock out to pasture on the third day. The milk obtained during the first 5 days is processed; adults can use it on the 6th day and children on the 25th day. Except for the upper 10-15-cm layer, it is permitted to use feed without any restrictions. Livestock are slaughtered for meat after veterinary cleansing without any restrictions. All agricultural crops can be used for nutritive purposes on the third day after the radioactive fallout.

//In subzone B-1 of the radioactive contamination//, work stability will be greatly dependent upon the people's observance of the procedures for their conduct and their accomplishment of the recommendations on conducting agricultural production. During the first four days, the populace must remain in radiation shelters and they must observe the established procedures. It is advisable to keep livestock in closed, sealed facilities. If weak and old livestock were located on open land and if they have eaten contaminated grass, it is recommended that they be slaughtered for meat after a veterinary cleansing. Cattle can be put out to pasture on the 4th day; milk can be used by adults on the 8th day and by children on the 30th day. Except for the upper 10-15-cm layer, it is permitted to use the feed without any restrictions. It is recommended that fields with isolated, heavily contaminated agricultural crops be reseeded and that the appropriate agrotechnical measures be conducted on a regular basis to grow a good harvest. When plant growth stops, they should be cut for silage or hay. Except for wheat, all agricultural crops can be used as food on the 3rd day after the radioactive fallout and wheat can be used 10 days after. After a preliminary cleansing, fruits and vegetables are used without any restrictions.

//In subzone B-2 of the radioactive contamination//, the facility's work stablity will be greatly dependent upon the measures for reliably protecting the populace, livestock, prepared agricultural produce, and also upon restoring and creating the appropriate stockpiles of food resources. The populace must remain in radiation shelters for a period of six days while observing the established procedures at the same time. During the first days after contamination, it is necessary to accomplish only the most urgent work on caring for the livestock, decontaminating the surrounding territory and several other jobs on eliminating the radioactive contamination. It is recommended that adult livestock be kept in facilities for three days and young livestock be kept in for a period of five days and it is recommended that they be given clean (not contaminated by radioactive substances) feed. It is permitted to take livestock out to pasture on the 7th day; adults can use the milk on the 10th day and children on the 30th day.

As a result of the effect of radioactive substances in subzone B-2, large crop losses are possible; moreover, individual crops will almost completely perish. It is recommended that everything possible be harvested from the fields, decontaminated and sent for technical processing. The fields where plants have died must be reseeded (early ripening crops are sown).

//Subzone B-3 of the radioactive contamination.// Under the conditions of the heavy radioactive contamination of this subzone, primary attention is first directed at reliably protecting the populace, livestock, food products, feed and water sources. It is primarily necessary to use well-prepared radiation shelters, sealed livestock and other facilities, appropriately protected water sources, individual protective gear and preventive medical gear; it is also necessary to strictly observe the procedures for the people's conduct and the procedures for keeping the livestock. During the first six days after a nuclear explosion, the populace must remain in radiation shelters and they must strictly observe the established procedures for their conduct. Upon the expiration of this period and during a period of 14 days, it is possible to work 8-10 hours a day and to spend the remaining time in residential facilities. During the first days, it is necessary to accomplish only the minimum of the extremely important work. During the first six days after the explosion, livestock must be kept in closed facilities and they must be kept in sealed facilities during the first days. Feed and water which is well sheltered can be used without any restrictions. It is permitted to put the livestock out to pasture on the ninth day after the explosion. The adult population can use the milk on the 10th day and children can use it on the 30th day. If livestock are located on open land during the radioactive fallout and during a period of 12-24 hours after the fallout, it is recommended that they be evacuated beyond this zone and immediately slaughtered for meat. Cereal grain crops and peas must be reseeded. Potatoes, root crops and fruit must be harvested.

The following jobs will be conducted: decontamination of the territory, produce, feed, various facilities; personal cleansing of people; veterinary cleansing of agricultural livestock; and specialized cleansing of equipment.

//The zone of dangerous radioactive contamination (C).// As a result of the dangerous radioactive contamination //in subzone C-1//, primary attention is directed at conducting timely and effective protective measures. The populace must remain in well prepared radiation shelters for a period of 10 days and they must observe the established procedures. During the first four days, the most urgent work on elementary life support activities for people and livestock must be conducted. The latter must be kept in sealed livestock facilities. Produce and feed will be covered up and stored in storehouses. For practical purposes, it is extremely difficult to conduct any work on growing plants. When necessary, it is advisable to harvest potatoes, root crops and fruit. The required work will be conducted on decontaminating the territory, produce, feed, facilities, sanitary cleansing of people, veterinary cleansing of livestock and specialized cleansing of equipment; the work on restoring agricultural production will also be carried out.

For all practical purposes, it is not advisable to conduct agricultural production //in subzones C-2 and C-3 of the radioactive contamination//. People, livestock, produce, feed and water sources must be reliably sheltered. If the opportunity presents itself, people and livestock must be evacuated to uncontaminated or less contaminated areas upon the expiration of five days.

These are the basic principles for ensuring stable work at agricultural facilities during wartime. At that time, reliable protection of livestock and livestock produce, plants and plant produce and also water sources against the effects of weapons of mass destruction is of exceptionally great importance.

3. Protecting Animals Against Weapons of Mass Destruction

When the threat of an enemy attack arises, work is conducted at the farm for the purpose of preventing destruction of agricultural animals or of minimizing the effect of weapons of mass destruction on them. Livestock and other facilities are prepared to protect agricultural animals. Rough and succulent feed and sources of water are covered. Stockpiles of the equipment required to eliminate the aftereffects of the employment of weapons of mass destruction are checked and set up; agricultural equipment is prepared to work in centers of destruction. Observation of the atmosphere, young plants and plant beds is increased for the purpose of detecting a nuclear explosion or the enemy's employment of chemical or biological warfare agents in a timely manner.

/Protecting animals in livestock facilities./ The livestock facilities which are on-hand at the farm and which are prepared in the appropriate manner are primarily used for group protection of animals. The preparation primarily consists of sealing them. For this purpose, clay, cement, lime (62% slaked lime, 32% water, 6% sodium chloride), clay-grease (3 parts clay, 1 part grease) and other mortars or plasters are put on the ceiling and cinders or sand are used as fill from above. Holes in the walls and between the window parts are filled with conventional or clay-grease putty. It is recommended that part of the windows be tightly sealed up with brick or panels and several windows should be left for natural lighting of the facilities; wooden panels covered with tarpaper or other thick material are made for them. It is best to seal the windows with film, attaching it along the perimeter of the wooden edges. For the best seal, the edges of the film should be pasted down with a clay-grease putty (3:1). Sealing the windows with film is the cheapest and most reliable seal for preventing the penetration of NBC agents or substances.

The doors to livestock facilities are repaired and covered with tarpaper, rubber-treated material or film. To reinforce the door frames, the places where they join the wall are filled with a cement or other mortar. The places where the door folds join are covered with a wide plank nailed half way up the door. A strip of elastic material--grooved or spongy rubber or felt--is attached along the entire perimeter of the door frame. The same kind of strip is nailed to the plank covering the hole between the folds of a double-fold door. If the door opens in, clamp bolts are attached to it for a tighter fit; if it opens out, draw-in bolts are put on it. Curtains made from a thick material are hung on the inside of door openings; they are tightly attached to the door frame. Entrances which are used on a daily basis are equipped with a vestibule of such size that it will be possible to open and close the outer door while located in it.

Ventilation ducts (shafts) and openings of the tributary ventilation system are packed with burlap bags or sacks filled with sawdust, hay, etc. from the facility side; the ducts are covered with a stopper (flap), but, in such a manner that the ventilation system can be opened quickly when necessary. For best protection against gamma radiation, dirt is heaped around the outside wooden walls up to approximately the windows (a height of 140-150 cm) or a fence is built at a distance of 50-60 cm from the wall and the space between the fence and the wall is filled with dirt.

If there is not enough room in the facility to set up a 5-7-day supply of feed, a sealed lean-to made from boards and covered with tarpaper is built for this purpose across from one of the doors or windows. A supply of clay or lime is kept in the facility near the doors to make mortar which can be used to cover holes which are discovered.

It is necessary to plow up the territory around the perimeter of the livestock farm to prevent fires from the burning dry grass. Panels with firefighting equipment are set up at a distance of 20-30 m from the facilities.

To protect the people who are taking care of the livestock, one of the inner rooms (a relaxation room) is equipped or a radiation shelter is built near the livestock facility. The plans for these shelters are developed with an exit way to the vestibule of the livestock facility. The minimal number of people--at least three people for one facility and 4-5 people per 150-200 milkcows at a milkcow facility--are left to take care of the livestock.

Depending on the type of facility, the filtration coefficients for the facilities which are prepared to protect livestock fluctuate from 130 to 300 for radioactive substances and from 40 to 60 for gaseous chemical agents (for the number specified, the concentration of radioactive substances or chemical warfare agents within the facility is less than the concentration outside by a factor of 1). Contaminated insects, ticks and rodents cannot penetrate these kinds of facilities. A brick livestock facility decreases the radiation by a factor of 10-15 and a wooden one decreases it by a factor of 3-5. When livestock are being kept in a sealed facility, conditions are created which promote the destruction of chemical warfare agents which penetrate it through holes (increased humidity and air temperature and the presence of ammonia). Due to the unique support of the temperature and air within such facilities, gaseous and cloudy substances and smoke cannot freely penetrate them.

A 5-7-day supply of feed (based on the minimal norms) is set up in a sealed facility; when there is no centralized water supply (from a well), water is stockpiled for the same period of time. At a fireproof distance from structures, an additional 7-10-day supply of hay, covered with the materials at hand, is set up on the farm's territory. The minimum daily norms of feed and water are: for cattle, about 5-6 kg of hay or about 4-5 kg of hay and 1-2 kg of concentrated feed and about 20-30 l of water; for sheep and goats, about 0.5-1 kg of hay and about 4-5 l of water; for hogs, about 6-8 l of water and about 2-3 kg of concentrated feed. Salt is eliminated from the ration. Feed supplies are put in special sections of the facilities, in feed passages and in lofts. It should be borne in mind that the feed will serve as an additional layer which decreases the gamma rays. Data on the changes for a few elements of the microclimate in a sealed cow barn are cited in Table 31.

Research has shown that cattle, sheep, goats and also hogs endure the increased temperature and humidity in a sealed facility with the most difficulty. To improve the microclimate in such a facility, litter with an increased moisture capacity should be used and measures should also be taken to reduce the content of ammonia and hydrogen sulfide in the air and to preserve the oxygen content. For these purposes, using kerosene devices for lighting is not recommended and it is not recommended that livestock be disturbed.

The length of time for keeping livestock in a sealed facility depends on the temperature and humidity of the outer air, the wind speed and the volume of air in the facility. When the

Table 31. Figures on the Microclimate in a Sealed Cow Barn.

| (1) Время исследования | (2) Температура в помещении (градусов) | (3) Относительная влажность (%) | (4) Содержание в воздухе помещения | | |
|---|---|---|---|---|---|
| | | | (5) углекислого газа (%) | (6) аммиака (мг/л) | (7) сероводорода (мг/л) |
| (8) Перед закрытием помещения | 15 | 94 | 0,2 | 0,022 | 0,0213 |
| (9) После закрытия через: | | | | | |
| 3 ч (10) | 19 | 95 | 0,6 | 0,204 | 0,186 |
| 6 ч | 20 | 95 | 1,14 | — | — |
| 12 ч | 22 | 100 | 4,77 | — | — |
| 14 ч | 22 | 100 | 7,36 | — | — |
| 15 ч | 21 | 100 | 6,3 | — | — |
| 20 ч | 21 | 100 | 6,5 | 0,218 | 0,13 |
| 24 ч | 22 | 100 | 6,89 | — | — |

Note: 1. These materials were obtained when pedigree heifers and cows with a daily milk yield of 7 l were kept in a facility for a 24-hour period. 2. The outer air temperature fluctuated from +16 degrees during the day to +2 degrees in the morning; wind speed fluctuated from 1.5 to 2.5 m/sec. After the livestock had been kept for 15 hours, the outer air temperature dropped to +2 degrees and the wind speed increased to 2.5 m/sec.

Key:

1. Study time
2. Temperature in facility (degrees)
3. Relative humidity
4. Contents of the air in the facility
5. Carbon dioxide (percent)
6. Ammonia (mg/l)
7. Hydrogen sulfide (mg/l)
8. Before closing the facility
9. After closing the facility:
10. Hours

outer air temperature is low and the wind speed is high, livestock can be kept longer than when the temperature is high, the wind speed is low and the humidity is high. Specifically, in a sealed, standard brick facility (with a norm of 16 cubic meters per cow, 12-13 square meters per young cattle up to 2 years of age and 6 square meters per hog), livestock can withstand the following conditions without any damage to their health: up to 72 hours in the winter with daily fluctuations in outer air temperature from -20 to -25 degrees and a wind speed of 2-4 m/sec and up to 90 hours with a strong wind (5-6 m/sec); up to 24 hours during warm seasons with an outer air temperature of +10 to +20 degrees and a wind speed of 0-3 m/sec and up to 34 hours with an air temperature of +8 to +16 degrees. In a sealed dugout, mudhut or remodeled silage trench, sheep weighing up to 46 kg with a norm of 3 square meters per animal can withstand: up to 20 hours on hot days with daily fluctuations in outer air temperature from 19 to 30 degrees and a weak wind (0-2 m/sec); up to 55 hours in early spring and late fall with an outer air temperature from -7 to +1 degrees and a weak wind; and up to 55 hours in the winter. After the time mentioned has passed, the facilities should be aired out for a period of two hours. Then, after half of the original time of the animal's stay in these facilities has passed, it is necessary to repeat the airing.

Ventilation pipes can be opened immediately after the radioactive dust has settled on the ground. In this case, the passage of radioactive dust into the facility through the ventilation pipe as a result of the secondary formation of dust does not present a threat to the animals. In the event the farm's territory is contaminated with sarin gas in the summer, it will evaporate and decompose several hours later (6 hours later with a soil temperature of 20 degrees and 12 hours later with a temperature of 10 degrees). As soon as the dangerous concentration of the chemical warfare agent disappears, it is necessary to partially unseal the facility immediately.

When equipping modern livestock facilities with a forced ventilation system, it is necessary to place a filter made from material at hand (Petryanov fabric or activated carbon) in the opening of the air intake and it is necessary to supply electrical power for operating the ventilation system and other machinery.

> The results of special studies have shown that, when a hog breeding complex for 2,600 hogs is sealed up and the forced ventilation system is switched off, the animals can be kept up to 6 hours in the winter if there is an average of 3.1 cubic meters of air for each animal. By the 6th hour, the air temperature in the facility increases to 12-14 degrees, the relative humidity increases to 100 percent and the carbon dioxide content increases to 1.4 percent. The pulse of the adult hogs increases to 130-140 per minute and their respiration goes up to 110-120.
>
> Poultry at integrated poultry farms was in even more dire straits when the ventilation system was shut off.

/Equipping other facilities to protect animals./ Vegetable bins, silage trenches, winter shelters, herbicide sheds and barns can be equipped for this purpose. They are sealed just like the livestock facilities are. A log ceiling is built over silage trenches, tarpaper or straw is laid over it and it is covered over with a 40-50 cm layer of dirt from above. Ventilation pipes with a cross section of 40 by 40 cm and with screens on the facility side are run through the roof to the outside; a vestibule with thick doors is built for an entrance. Several windows which are sealed with film are made for natural lighting. Quarries, ravines and recesses in the ground can be equipped in the appropriate manner.

If there not enough livestock and other facilities, it is recommended that mudhuts and dugouts with sealed entrances and sealed ventilation systems be built to protect cattle. For dugouts, a 2.5-3 m deep and 3-4 m wide trench is dug; a log ceiling is built over it and it is covered by a 40-60 cm layer of dirt. The ground water level should be taken into consideration when constructing dugouts. When the ground is weak, the walls are reinforced with wattle or boards. Troughs are built inside the dugouts and mudhuts; drainage channels for urine and a pit for feces are dug out. A dugout is built for 2-4 animals and a mudhut is built for 6-10. Especially valuable livestock can be sheltered more reliably in dugouts.

The protective properties of the terrain can be used to protect livestock against overexposure during the shock wave and cloud of a nuclear explosion: ravines, canyons and large woods. The radiation protection coefficient of woods is 2. Livestock must be driven into the woods to a distance of at least 500 m from the edge of it. Sheltering livestock under cover in the woods ensures more reliable protection for them. Sparse woods and bushes cannot serve as protection against NBC agents and substances.

Ravines and canyons cannot be used to protect livestock against BC warfare agents which accumulate in the low lands and remain there for a long time.

/Evacuating livestock./ With the onset of the danger of an attack, livestock are evacuated to safe distances from farms located near major cities and important industrial installations. They are also taken out of areas where flooding is anticipated. In these cases, previously prepared mudhuts, depressions in the ground, canyons, utility buildings, etc. are used at the cattle marshalling areas (they are prepared to protect livestock as pointed out above). Livestock are evacuated by motor vehicle transport or they are driven. For these purposes, railroad transportation can also be used.

/Protecting livestock in transit./ When cattle are being transported through centers of contamination by motor vehicle and by rail or when they are being carted out of areas with a dangerous level of radioactive dust contamination, all necessary measures are taken so that people and livestock do not become contaminated during transport. The hatches and doors of railroad cars are closed. Livestock in motor vehicles are covered with material at hand (film, tarpaulin). During the trip through a center of contamination, individual protective gear is used for the respiratory organs of people and livestock. The transport passes through a center of contamination at high speed and without any stops (Figure 63) [figure not reproduced].

/Individual protective gear for livestock./ This gear is primarily intended for highly valuable livestock and also for those cases where cattle are being driven (carted) out of centers of contamination. Protective masks are made from the material at hand to protect the respiratory and digestive organs of cattle and horses. The protective mask consists of a case, a bottom and a strap. The case and bottom of it are made from three layers of burlap with a filtering material placed between them: oakum, wool, moss. The PAF [Petryanov analytical filter] or the PABF [Petryanov absorptive filter] are the best material for filters. Straps are sewn on the mask to attach it to the animal's face and so the edges of it will fit snugly against its face. Six pockets are made along the entire length of the perimeter of the case and small wooden sticks 15-17 cm long are put in each of them (they give the mask a stable form and keep it from clinging to the animal's face when it inhales).

Stiff paper covers, as well as tarpaulin, film, burlap, straw mats, etc., are used to protect the skin of animals. The limbs of animals are protected against chemical warfare agents by tarpaulin stockings treated with oil; after first wetting the limbs with water, they can be smeared with a clay-lime paste (1 bucket of clay, 2 l of water, 1.5 kg of bleaching powder). The limbs are protected in those cases where it is necessary to drive animals through a center of chemical contamination.

/Protecting animals when livestock has been driven out./ Under these conditions, the protective features of the terrain are usually used; covered dugouts are also built and winter shelters and herbicide storehouses (where they exist) are remodeled. Driving or carting cattle from the area where radioactive fallout is anticipated to a safe place is also resorted to. In distant pastures, it may be possible to successfully drive livestock to this kind of place and on to a major city after the nuclear strike is delivered. The speed for driving cows is 25-30 km a day; it is 15-20 km for sheep. When conducting these measures, a large role is allocated to communications and timely notification of the livestock teams on beginning the livestock drive and on the route direction. The routes for the cattle drive, the areas for assembling them and the care required are planned in peacetime.

/Preventive treatment against animal contamination./ Measures such as vaccination and controlling insects, ticks and rodents play a large role in protecting animals against contamination by biological warfare agents. By conducting specific vaccination of animals against especially dangerous infectious diseases in a timely manner, it is possible to prevent the appearance and spread of infectious diseases. Obviously, it is advisable to conduct preventive innoculations for animals only in the most probable areas for the employment of biological warfare agents by the enemy. The difficulty in conducting these measures consists of the fact that it is impossible to determine ahead of time which agent will be used by the enemy. In addition, at present, there are no specific vaccinations and serum for several infectious diseases (glanders, African swine flu, etc.).

As possible carriers of infectious diseases, insects are destroyed with special chemical substances--insecticides--and ticks are destroyed with acaricides (dipterex [$CCl_3CH(OH)P(O)(OCH_3)_2$], trichloromethylphosphate-3, polychloropinene, cyodrine and others). Repellents (diethyltoluamide and others) are used to scare insects away. Various poisonous bait (food and water) is used to exterminate rodents (exterminate rats). Zoocoumarin, rat poison, ratindine and zinc phosphide are used.

Special preparations are used to prevent radiation contamination; these preparations increase the body's resistance against the effects of ionizing radiation (protectors). They are introduced in a muscle, under the skin, in a vein or given internally 1-4 hours before irradiation. These preparations can be used, for example, when it is necessary to transport animals across an area with large radiation levels (when transporting them out of an area with a dangerous level of radioactive contamination). Cysteine, cystamines (RS-1 [expansion unknown]), mexamine, (cystaphosphate) and AET [aminoethylisothiuronium] preparations have a preventive effect.

4. CD Measures to Eliminate the Aftereffects of the Enemy's Employment of Weapons of Mass Destruction on Livestock Farms

In a center of nuclear destruction, in the path of a radioactive cloud and in centers of chemical and biological contamination, measures are conducted to save livestock. These measures include warning, reconnaissance of centers of contamination, evaluating the situation which has developed at a particular farm, measures to save and protect livestock from weapons of mass destruction and rendering medical assistance to them, decontaminating the territory, buildings, equipment, water and the bodies of animals, conducting dosimetric monitoring and resolving the issue of economic utilization of injured cattle and poultry.

/Operations to save livestock and fodder in a center of nuclear destruction./ Rescue operations on livestock farms within a center of nuclear destruction are distinguished by their high level of complexity and exceptional difficulty since a large volume of them must be conducted within the shortest possible time. The complexity of these operations consists of the fact that they must be conducted in destroyed buildings, under smokey conditions and under conditions of radioactive contamination. Rescue operations consist of putting out fires in cattle yards, rescuing livestock from burning and destroyed buildings, leading them out to safe places, rendering urgent medical assistance and first aid to injured livestock and also saving fodder and restoring the water supply machinery. Measures are also taken to restore the power system.

Rescue operations in places where feed grain is stored boil down to putting out fires at the storehouses, ensuring the safety of work in damaged buildings and removing damaged and unsuitable feed.

When conducting rescue operations at night, it is important to: organize lighting, regulate traffic on the farm's territory, increase reconnaissance and external observation and ensure safe working conditions for personnel. If rescue operations are conducted in the winter, it is necessary to: organize clearing work for the paths to bring out livestock, check up on the presence of warm clothing for formation personnel and establish a place for people to warm themselves.

When rescuing livestock from destroyed and burning buildings, it is necessary to remove the danger of obstructions first by tearing down hanging structures or propping them up with temporary supports. Animals held down by collapsed parts of buildings are extracted after uninjured or injured, but able to move, cattle are driven out.

Safety measures are strictly observed when conducting rescue operations. Perimeter posts and patrols are put out at dangerous places and warning signs are also set up. People organize mutual safety measures for each other and strict observation is set up for people working in smoke or gas filled buildings.

After conducting the rescue operations, the bodies of dead animals are buried at the cattle graveyard and injured animals are given medical assistance or preventive aid depending on the nature of their injury (wounds, burns, bruises).

### Measures in Zones of Radioactive Contamination

Reconnaissance is conducted in zones of radioactive contaminated land; the situation is evaluated based on the actual radiation levels; the possible rate of sickness and death is estimated for the livestock and the sequence and volume for carrying out the required work are planned (veterinary cleansing of livestock, treating or slaughtering injured animals, decontaminating facilities, the farm's territory, objects for caring for livestock, feed, water, etc.). Procedures for protecting people and animals, as well as procedures for working in a center of contamination, are established.

/Procedures for protecting and keeping animals in zones of radioactive contamination./ Animals located in sealed facilities will be reliably protected against contamination from radioactive substances. The animals must remain inside the facilities until the danger of their being contaminated outside the facilities is eliminated. When there is no danger of a facility being contaminated, the ventilation system in it is opened. The procedures for protecting and keeping animals in zones of radioactive contamination are shown in Table 32.

In zone A, animals can be driven out of the facilities to pasture in 1-4 days; by this time, the radiation level in the pasture will have decreased to 0.5 roentgens/hr. However, radioactive isotopes of iodine (higher than the permissible amount) will still be contained in the milk of lactating animals and it will have to be processed for butter during the following 3-5 days. Children can only be given this milk 15-25 days after the cows begin grazing. Even stricter procedures are established for zones B and C; moreover, milk cattle cannot be given local feed in zone C--not only during the first months after the farm's territory is contaminated by radioactive dust but not even during the several years which follow--since the strontium-90 content in the milk will be higher than the permissible amount in this case.

In the event people are evacuated from zone C, animals are also removed from it. Service personnel engaged in loading livestock on transport and transferring it through contaminated territory must not be irradiated higher than the permissible amount. Therefore, it is important to calculate the time for beginning the evacuation.

Table 32. Procedures for Protecting and Keeping Animals in Zones of Radioactive Contamination.

| (1) Зоны | (2) Доза облучения – $Д_{\infty}$ до полного распада РВ* (р) | (3) Уровни радиации (р/ч) после взрыва через 1 ч | 10 ч | 24 ч | (5) Через сколько суток можно проводить эвакуацию животных | (6) Через сколько суток разрешается пастьба скота** | (7) В течение скольких суток после начала пастьбы коров молоко следует перерабатывать на масло*** | (8) Через сколько суток после начала пастьбы коров молоко можно давать детям | (9) Рекомендуемое направление развития животноводства при постоянном проживании населения |
|---|---|---|---|---|---|---|---|---|---|
| | 10 000 | 2000 | 125 | 44 | 12 | — | — | — | |
| | 4 000 | 800 | 50 | 17,6 | 5 | 20 | — | — | |
| (10) В-2 | 3 000 | 600 | 37 | 13,2 | 4 | 15 | — | — | Мясное (18) |
| (11) В-1 | 1 200 | 240 | 15 | 5,3 | 2 | 10 | — | — | |
| (12) Б-3 | 800 | 160 | 10 | 3,5 | Не обязательно (15) | 8 | 10 | 30 | Мясное и молочное (19) |
| (13) Б-2 | 600 | 120 | 7,5 | 2,6 | Не эвакуируют (16) | 6 | 8 | 30 | |
| (14) Б-1 | 400 | 80 | 5 | 1,7 | То же (17) | 4 | 6 | 25 | |
| А-4 | 300 | 60 | 3,8 | 1,3 | » » | 3 | 5 | 25 | Молочное (20) |
| А-3 | 200 | 40 | 2,5 | 0,9 | » » | 2 | 5 | 25 | |
| А-2 | 100 | 20 | 1,2 | 0,4 | » » | 1 | 5 | 25 | |
| А-1 | 40 | 8 | 0,5 | 0,2 | » » | 0,5 | 3 | 15 | |

*It is determined according to the formula: $D_I = 5 \cdot P_o \cdot t_o$

** For the times shown, the level of radiation on the ground will be reduced by a factor of 0.5 roentgens/hr.

*** Subsequently, milk can be used in its natural form by adults without any restrictions.

Key:

1. Zones
2. Dose of irradiation--$D_I$ until complete decay of radioactive substances (r)*
3. Radiation levels (roentgens/hr) after the explosion
4. Hour
5. How many days later can animals be evacuated
6. In how many days can livestock be put out to pasture**
7. For how many days should milk be processed into butter after cows are put out to pasture***
8. For how many days after cows are put out to pasture can milk be given to children
9. Recommended direction for developing livestock breeding for continual life of the population

10. C-2
11. C-1
12. B-3
13. B-2
14. B-1
15. Not mandatory
16. Not evacuated
17. Ditto
18. Meat
19. Meat and milk
20. Milk

/Driving cattle./ In the event pastures are threatened by radioactive contamination or when they are already contaminated, cattle in dispersed livestock breeding areas are driven as quickly as possible to the side (perpendicularly) away from the direction of the wind's movement. It is best to use roads with a hard surface or areas with low grass for the drive. When driving livestock along land contaminated by radioactive substances, the animals are not given grass to eat. The radiation dose which people will receive while driving the livestock is calculated. It must not exceed 50 roentgens during a 4-day period. Personnel tending the animals use individual protective gear (respirators, dust tight cloth bandages). Upon coming out of a center of radioactive contamination, animals undergo veterinary cleansing and people carry out personal cleansing.

/Time periods for starting cattle grazing in zones of radioactive contamination./ When determining the time periods for starting cattle grazing in areas located along the path of a radioactive cloud or when determining the possible time for mowing grass here to feed animals, a number of factors are taken into account and primarily the possibility of people being able to work safely on radioactive contaminated land. Meat and draft livestock can begin grazing when the radiation level decreases to 0.5 roentgens/hr and lactating animals can begin when the radiation levels are no greater than 0.1 roentgens/hr if the milk is intended for the adult population and even later if it is intended for children. At these radiation levels, grass can be mowed to feed lactating cows, goats and sheep.

In the event of a nuclear missile war, plant foliage will also be contaminated by radioactive substances as a result of worldwide radioactive fallout from the troposphere and stratosphere. Fallout from the stratosphere occurs during the 2-3 month period after the explosion; moreover, it contains isotopes with a long life and isotopes with a small half-life (iodine-131, tellurium-132, barium-140, strontium-89 and others).

Special calculations show that, when milk cows are maintained by grazing, the milk will be unsuitable as food in its natural form for a period of several weeks due to the increased radioactivity. Stratospheric fallout continues for at least seven years; it only contains isotopes with a long life (strontium-90, cesium-137 and others). The additional contamination of feed, pasture grasses and young agricultural crops must be taken into account when resolving the issue on the time periods for beginning livestock grazing, feeding them mowed grass and using the crops in an economical manner.

Decontamination of livestock facilities, objects for caring for animals, the territory of the farm and, when necessary, feed and water is carried out in zones of radioactive contamination.

Measures in a Center of Chemical Contamination

In a center of chemical contamination, production activity is only possible after the sites and facilities which people and animals can come into contact with are completely decontaminated. In connection with this, thorough reconnaissance is conducted on the farm's territory after the type of chemical warfare agent is determined. Contaminated territory is clearly defined and its borders are marked with standard barrier signs or with the means at hand. Formation personnel carry out rescue operations here in their individual protective gear (gas masks, rubberized suit, rubber boots, rubber gloves).

Measures for saving animals in a center of chemical contamination are directed at stopping the entry of chemical warfare agents into the body, stopping their action (veterinary cleansing) and conducting antidotal and symptomatic treatment. The entry of chemical warfare agents into the body is stopped by using individual protective gear, by cleaning visible spots of poison on the skin with decontaminants, by taking animals out of a center of contamination and by conducting a subsequent veterinary cleansing of them. Antidotal treatment is conducted either directly in the center of contamination or immediately after the animals are let out of the center but before the veterinary cleansing.

Decontaminating livestock facilities and the farm's territory is one of the important measures.

Antidotes are given to animals contaminated by organic phosphorus chemical warfare agents and by systemic gases as soon as possible moreover, the sooner the antidote is given after posioning, the greater the number of injured livestock that will be saved.

Phospholitine*--alone or even better in solution with TMB-4** [expansion unknown]--is used as an antidote against organic phosphorous chemical warfare agents. The solutions are prepared separately with sterile distilled water or thoroughly boiled water and then mixed: 1.5 parts of a 75 percent solution of phospholitine and 1 part of a 20 percent solution of TMB-4. A 15 ml dose of the mixture is injected into the muscles of adult cattle, adult horses, camels and buffalo; the young of these species are given a 4 ml dose; adult deer and donkeys are given a 5 ml dose and young animals are given a 1 ml dose; adult hogs are given a 2.5 ml dose and young hogs are given a 0.6 ml dose; sheep and goats are given a 1 ml dose and young sheep and goats are given a 0.2 ml dose. The cited antidote can also be injected after the appearance of convulsions.

Of the other antidotes, a solution of water and atropine or platyphyllin (they are injected in the muscles with consideration for the live weight and type of animal) and also thropacine (5-10 mg/kg), which has a central effect, can be used. TMB-4 increases the curative effect of atropine, thropacine and phospholitine.

With russic acid posioning, it is necessary to use amyl nitrite (by inhalation) as quickly as possible; it forms a compound (methemoglobin) in the body which easily unites with the posion. About 10-20 ml of amyl nitrite is poured onto the mucous membrane of the nose for large animals and about 0.5 ml of it are used for small animals. Injured animals are subsequently treated with other antidotes. As yet, there is no antidote for mustard gas.

Animals are transported from a center of chemical contamination by motor vehicle or they are led out after passages are decontaminated. If animals were located in well sealed facilities, they are left in place; only a decontamination of the firm's territory and livestock facilities is conducted immediately. Antidotal treatment is employed when people are contaminated during their work in a center of chemical contamination. After working in such a center, all personnel go through personal cleansing.

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*An aromatic light yellow, thick oily liquid. It is an agent with a central muscarinic, cholinolytic effect but it does not restore the activity of the cholinesterase.

**A yellowish-white crystalline powder which dissolves well in water. It restores the activity of the cholinesterase and thereby increases the curative effect of phospholitine.

Basic Measures to Eliminate a Center of Biological Contamination

Measures to eliminate a center of biological contamination depend on the type of agent and the method of its employment. The season and time of day, weather conditions, the level of preparedness of formations and institutions and the presence of manpower and equipment have a great effect on the work conducted. Measures are conducted in two stages in a center of contamination.

/The first stage/--until the type of agent is determined. Overall anti-epizootic and anti-epidemic measures are carried out: a quarantine is levied, the size of the center of contamination is established, samples are taken and they are sent to a laboratory to determine the type of infectious disease agent (when there is a field laboratory present, this can be done on the spot using quick methods).

//A quarantine// is a system of strict anti-epizootic and anti-epidemic measures to seal off (isolate) the entire center of contamination and to eliminate the infectious disease in it. It is established by a decision of the executive committee of the Soviet of People's Deputies (rayon, oblast, republic). Guard posts (police, teams for preserving law and order, military teams) are set up on all the roads around the quarantined territory and warning signs with instructions for detours are set up. The quarantine measures provide for stopping entry to and exit from the center of contamination by vehicle or on foot and stopping any kind of property being brought out of it without decontamination. The passage of people, animals, transport is prohibited. Markets, entertainment facilities and educational institutions can be closed. Measures are conducted to eliminate infection in the center of contamination.

/The second stage/--after the type of agent is determined. The quarantine is either left on or it is replaced by a regime of observation (for infectious diseases which are not transmitted through contact between sick and healthy organisms).

//Observation//is established at a farm for problems with infectious diseases; restrictive measures and isolation are carried out at the same time. Observation provides for: an increase in medical and veterinary observation in a center of contamination; restricting travel to and from it and also restrictions on taking various property, animals and fodder from it; isolating and treating people or animals which are sick or suspected of being sick; conducting vaccination and disinfection.

A quarantine is left on for Siberian ulcer, glanders, plague, encephalomyelitis, cholera, psittacosis epidemic typhus and for diseases not encountered within the territory of the USSR.

In the event the enemy employs an agent which makes people sick, all people who are sick and suspected of being sick are isolated and treated in the quarantined area; all people are examined by means of a list for rounds; buildings, clothes and shoes are disinfected; monitoring of water sources and food products is increased; immunizations are given or special preventive antibiotics are given; anti-epidemic work procedures are established for work facilities. Access to the center of contamination is only permitted for personnel and for people who will participate in conducting the measures to eliminate the center of contamination. In these cases, the people granted access to the center of contamination are vaccinated first.

The extent of the measures and the methods and means of controlling different infectious illnesses are not the same and the length of the quarantine is also different. Therefore, depending on the type of agent, measures are conducted in a center of biological contamination in accordance with the current instructions and manuals approved by the Main Veterinary Administration of the USSR MA [Ministry of Agriculture]; moreover, all work is conducted in coordination with medical service employees. When conducting measures to eliminate infectious diseases, people are guided by the appropriate instructions and manuals approved by the USSR Ministry of Health.

The responsibility for complying with the rules of a quarantine and for conducting measures to eliminate infectious diseases as quickly as possible is levied on farm and enterprise executives, local authoritative agencies and agencies of the Ministry of Agriculture and Health in the localities.

## Veterinary Treatment of Animals

During veterinary treatment of animals, radioactive substances are removed from the outer surfaces of their bodies, chemical and biological warfare agents which have fallen on their skin are removed or decontaminated and first aid is given to injured animals. Veterinary treatment has the goal of preventing the illness of animals subjected to the effects of NBC agents and substances, of making work safe for personnel tending injured animals, of ensuring the possibility of using the maximum number of injured livestock for meat and other farm needs and, in the event of biological contamination, of not permitting the infectious disease to spread.

All animals located in a center of chemical or biological contamination and those which are contaminated by radioactive substances above the permissible amount are subjected to treatment.

Spec. .l areas are set up for veterinary treatment of public livestock. Privately-owned livestock is treated on the spot.

In warm weather, the //veterinary treatment area// (Figure 64) is set up on land with a permissible level of radiation, beyond the borders of a center of chemical contamination and on the boundaries or within the territory of a center of biological contamination. In the latter case, the territory for the treatment area and the territory for keeping treated animals are disinfected.

The area selected is near a source of water, not closer than 100-200 m to through-roads and livestock facilities and preferably on ground which is distinguished by a good capability to absorb water (sandy). There must be good approach routes to the area.

In cold weather, the area is set up inside a facility, which makes it possible to conduct the required work. When the appropriate facilities are present at a farm with a sufficient supply of water, a hard floor and a drain pipe for waste water, animals can also be treated inside this facility in warm weather. In the cases cited, waste water enters a collector; from here, it is taken to safe places for burial in vessels if the radioactive level of the water is high. When treating animals contaminated by biological or chemical warfare agents, the water in the water collector is also decontaminated.

The size of the area is determined by the number of livestock which must be treated at the same time; for this purpose, approximately 30 square meters are calculated for each animal.

The area is divided into "contaminated" and "clean" parts. A pen for contaminated livestock is set up in the area; it changes to a divider and then to a corridor 0.8-0.9 m wide, which is partitioned into 5-6 animal treatment stops; beyond the stops is a passage (up to 10 m) and a stop for dosimetric monitoring of animals; the latter has a movable bar on the side to drive animals through to the side pen. All of this makes up the "contaminated" part. Drainage ditches are dug on both sides of the corridor, and pole, board, etc. planking is put over the ditches for the convenience of operating personnel. Firm flooring is also put inside the stops so there will not be any mud in them during treatment of animals. At a distance of 10 m from the stops, a pit is dug to absorb the drainage water;

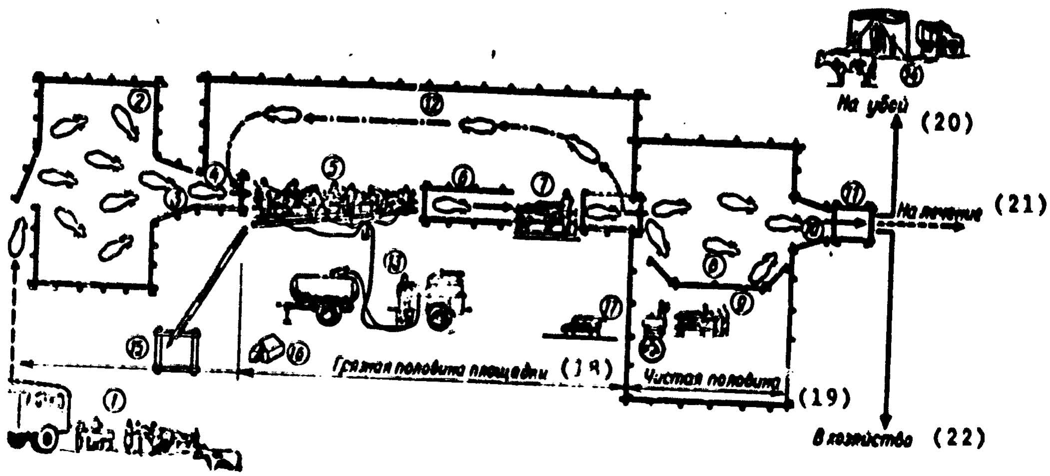


Figure 64. Veterinary Treatment Area

Key:

1. Reception and sorting point
2. Pen for contaminated animals
3. Divider
4. Passage-stop
5. Veterinary treatment stops
7. Dosimetric stop
8. Pen for treated animals
9. Veterinary aid position for treated animals
10. Divider
11. Animal sorting stop
12. Animal holding pen
13. Equipment for cleaning animals
14. Field slaughtering point
15. Filtered well
16. Position for personal cleansing of people
17. Rest site for people
18. Contaminated part of the area
19. Clean part
20. To slaughter
21. To treatment
22. To farm

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this pit connects the ditch with the drainage ditches coming from the stops. A position is installed in the "contaminated" part to clean overalls and articles for tending animals and for personal cleansing of people; a device is set up to unload animals arriving by motor vehicle. For animals requiring repeat treatment, a pen is set up to the left or the right of the corridor. Livestock are driven into it to be held for treatment in the event of their contamination by chemical and biological warfare agents.

The corridor ends at the pen for treated animals. This is the "clean" part of the area. A position is set up to conduct preventive medical measures in the pen. Positions are also set up in the "clean" part for personnel rest and for parking special vehicles; a dock for loading animals is built here.

The veterinary treatment area for animals is situated so that the flow of animals from the "contaminated" part to the "clean" part proceeds against the prevailing winds for the given area. Poles, boards and other materials at hand are used to set up the corridor and pens. When necessary, a field slaughtering point is set up near the area.

/Methods and equipment for veterinary treatment of animals./ //Dry treatment.// When the skin of animals is contaminated by radioactive dust, this treatment can be conducted by using the appropriate machines (the veterinary disinfecting machine) and vacuum cleaners. The radioactive dust collected by them is buried in the ground. Shearing is the best method of dry treatment for sheep.

When the skin of animals is contaminated by chemical warfare agents, bleaching powder or calcium hypochloride is sprinkled on the surface of their bodies; then, this is worked into the hair with a broom made from material at hand. Treatment begins with the sections of skin with the greatest contamination; after this, the head, neck, forward limb, body and rear limb of one side are treated in sequence and then the other side is treated in the same order. About 15-30 minutes after treatment, the bleaching powder should be removed from the skin with a brush, rags or straw broom.

//Wet treatment.// It consists of treating the skin of animals //contaminated by radioactive substances// with solutions of water and (surface acting) detergents and by using various machines. For this purpose, a 0.3 percent solution of SF-2 or SF-2U powder or a 0.3 percent solution of OP-7 emulsifier or OP-10 with a 0.7 percent solution of sodium hexametaphosphate added to it are used as detergents. [expansion of abbreviations unknown] In the absence of the items named, solutions of water and "Novost'" Powder, sulfanol or normal tallow soaps are used. The standard FA-1 [foaming agent] foaming agent provides good results. If none of these items are present, the skin can be washed with clean water under 2-3 atmospheres of pressure.

Chlorinating and oxidizing decontaminating agents and basic decontaminating agents are used to treat the skin of animals //contaminated by chemical warfare agents.// Of the former, the following are used: bleaching powder (in paste form--2 kg of bleaching powder per 1 of water--or as a solution); calcium bihypochlorite (BHC) or 2/3 the basic salt of calcium hypochlorite (CHC) (as a watery paste--in a ratio of 1:4 for BHC and in a ratio of 1:10 for CHC); a 3 percent solution of water and potassium permaganate acidified with a 1 percent solution of acetic or hydrochloric acid (used when the skin is contaminated by nitrogen mustard gas). Of the basic decontaminating agents, the following are used: sodium hydroxide (in the form of a 0.5 percent solution in water), a 10-12 percent solution of water and ammonia (for sarin contamination), sodium carbonate and sodium bicarbonate (in the form of a 2 percent solution to decontaminate the mucous membranes of the eyes and of the nasal and mouth passages).

Solutions of water and the following agents are used to treat the skin of animals //contaminated by sporous microbes//: an 8 percent solution of monochloride of iodine; a solution of trichlorinated cyanuric acid containing at least 7 percent active chlorine; a 3 percent solution of hydrogen peroxide in a 0.5 percent solution of formic or acetic acid; a 10 percent solution of 2/3 the basic salt of calcium hypochlorite; a purified solution of bleaching powder containing at least 4 percent active chlorine. Solutions of the same preparations are used when //the skin// of animals //is contaminated by viruses or microflora which do not form spores// but in concentrations reduced by a factor of 1.5-2. In addition, a 3 percent suspension of 2/3 the basic salt of calcium hypochlorite and a 4 percent solution of water and chloramine can be used for these purposes. The solutions named are prepared immediately before use.

To soak the hair (wool) of animals with the disinfecting solutions better, it is good to add 0.01 percent of an emulsifying agent (OP-7, OP-10, SF-2, sulfanol) to them before use.

The solutions of bleaching powder and trichlorinated cyanuric acid are prepared according to the special instructions. Veterinary (KDV-2 [Komarov decontamination vehicle], LSD-2 [expansion unknown]) and other equipment (sprayers, gas trucks, oil trucks, chemical spray trucks, etc.), which are equipped with a receptacle to distribute the water, are used to put the solutions and water on the animals' bodies.

The 2/3 the basic salt of calcium hypochlorite solution, the chloramine B solution which contains 4 percent active chlorine and the hydrogen peroxide in acid can be used with the directed aerosol method by using the veterinary decontamination vehicle (VDV) for this purpose. When using the aerosol method, 3 times less of the disinfecting solution required for veterinary treatment is used than when the solutions are used to wash down the body of an animal.

/Procedures for veterinary treatment of animals./ The procedures and sequence for treating the skin of animals depends upon the type of contaminating agent (chemical, biological or radioactive). First of all, decontaminated animals are sorted by type and severity of contamination; after this, the type of agent required to clean the skin is determined and designated. At the same time, the problem of whether preventive medical agents are required is solved. In the event the skin is contaminated by //radioactive substances//, selective dosimetric readings are taken and the animals are inspected. When the skin is contaminated higher than the permissible amount, the animals are selected for veterinary treatment.

The livestock undergoing treatment are driven into the pen; from here, they are sent through the divider in groups of 5-6 animals (depending on the number of stops) to the veterinary treatment stops. Using a shower brush, each animal is treated with the appropriate solution on both sides. To avoid contaminating people, the brushes are attached to a 80-100 cm long stick; the hose is placed along this stick; the solution passes along it to the brush. The rear of the animal is treated first, then the head, neck, back side, forward and rear limbs (from top to bottom). After being treated with the detergent solution, the animal is washed down with clean water.

The animals are driven one at a time to the last stop where dosimetric monitoring is conducted. If the level of radioactivity has decreased to the permissible level, the animal is sent to the pen for "clean" livestock; if the level of radioactivity is still above the permissible limit, it is sent back through the side pen for repeat treatment.

Up to 65-70 percent of the radioactive substances can be removed from the bodies of cattle and horses with the detergents. Repeat treatment is less effective: less than an additional 10 percent of the remaining radioactive substances are removed.

//Foam treatment.// Foam is fed under pressure from the standard FG-1* foam generator of a firetruck onto the animal and it covers the entire surface of its body. After a 2-3 minute contact, the foam is cleaned off with brushes on long handles and up to 65-75 percent of the radioactive dust is removed from the hair and skin along with it. After this treatment, it is not necessary to wash down the animals with water.

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*The standard foam generator consists of a kerosene contact containing 44-84 percent sulfonic acid, a small amount of stiff adhesive, undistilled alcohol and sodium hydroxide; in a 4-7-percent concentration, it will not freeze at -8 degrees C.

If there are no detergents, animals are washed down with water (against the wool) from a fire pump; the water is fed under a pressure of 2-3 atmospheres. In this case, 30-50 percent of the radioactive dust is washed away.

When animals are contaminated by //posionous agents,// the type of agent employed by the enemy is determined first and then the treatment begins. When the contamination is by organic phosphorus agents, antidotes are injected into the animals' muscles before veterinary treatment.

When the contamination is by binary gases and mustard gas, preparations which give off chlorine are used for treatment; when the contamination is by sarin and lewesite, a solution of sodium hydroxide or ammonia is used; when the contamination is by nitrogen mustard gas, a solution of potassium permaganate is used.

After thorough treatment with the solutions cited, the animals are driven into the side pen for a 20-30 minute detention, during which the chemical warfare agent decomposes. Then the animals are again driven to the stops where they are washed down with water to remove the decontaminating agent and the decomposed products of the chemical warfare agents; after this, they are led to the clean part of the area.

When animals are contaminated by //biological agents,// veterinary treatment is conducted as quickly as possible immediately after the fact of the aerosol employment of biological warfare agents has been established and without waiting to establish the type of agent employed. In these cases, solutions of disinfecting agents are employed against the microflora which form quickly. During veterinary treatment, the surface of the animal's body is soaked abundantly and completely with the particular solution. For this purpose, the following amounts of disinfecting agents are expended (1): 20-25 per adult horse and per adult cattle; 12-15 per calf and sheep; and 4-5 per hog. The animals treated with the solution of disinfectant are driven from the stops to the side pen and they are detained there for an hour (during this time, the microorganisms and viruses will be killed); after this, they are again driven to the stops, washed down with warm water and led to the clean part. During hot, summer weather, the animals are treated with the solution of disinfectant again 25-30 minutes later (after drying out) so that the animal's body will be exposed to the disinfectant solution for at least one hour. After treating the skin with the disinfectant solution, the animals are injected with chemotheraputic agents (sulfa drugs) and antibiotics (tetracycline, etc.) and, after establishing the type of agent, with specific sera and vaccines.

When animals receive a //multiple contamination,// they are first treated with decontaminating solutions to destroy and remove the chemical agents. The solutions used for this purpose are also effective when the animals are contaminated by biological agents which do not form spores; when the animals are thoroughly washed down, radioactive substances are also removed from the surface of their bodies. Then, when necessary, the animals are washed down with disinfectant solutions primarily to destroy microbes which form spores. During a 10-hour period, 160-200 large agricultural animals can be treated at a single sterilizer. The treated animals are either sent to the farm, for treatment or to slaughter.

For wet veterinary treatment of hogs, sheep and calves, it is advisable to build a cage with a lattice floor and with space for 10 head within the dirty part of the area and conduct group treatment for animals here. Radioactive dust is removed by water being fed from any sort of machine under a pressure of 3 atmospheres. In the event hogs, sheep or calves //are contaminated by chemical or biological agents,// they are treated with decontaminating solutions in the same manner as large animals are. Sheep, goats and hogs contaminated by biological agents can be treated by swimming in a tub filled with a solution of monochloride of iodine or hydrogen peroxide in the concentrations cited above and by subsequently detaining them for a 1-hour period. Then, the animals are washed down with water. Poultry //contaminated by radioactive substances// are washed down directly in their cages and, at integrated poultry farms, in the sanitary cleansing chambers located at the poultry receiving shops. The solutions are prepared based on the calculation of 1 l per chicken, 1.2 l per duck and 1.5 l per goose. When //poultry is contaminated by chemical warfare agents,// it is recommended that they be washed down with a 0.5 percent solution of sodium hydroxide or a solution of 2/3 the basic salt of calcium hypochlorite. Agricultural poultry is also decontaminated in shower chambers.

Personnel conduct veterinary treatment of animals in their individual protective gear. When the animals are contaminated by radioactive substances, the respirator can be used in place of the gas mask. Upon completing the work, the equipment, technical gear and overalls are decontaminated. Personnel go through a complete personal cleansing. If future work is not anticipated in the area, the drainage ditches and the pit for drainage water are covered up with dirt, the contaminated part is fenced in and warning signs are placed at the corners of it with the sign: "Contaminated!."

## Decontaminating Equipment

Agricultural equipment is decontaminated in a specially equipped area where docks are built for the vehicles and drainage ditches are dug around the dock.

//Radioactive dust// is removed by solutions of water and detergents (SF-2U SF-2, tallow soap) with shower brushes attached to fire pumps. The expenditure norms for the solution are 2.5-3 l/square meter. The vehicles can be treated by a powerful stream of water from the fire pump (20 l/square meter). In the winter, the vehicles are dried with solvents--kerosene, diesel fuel, gasoline.

//Posionous agents// are destroyed by a watery paste of bleaching powder or calcium hypochlorite and also by ammonia water or a special alkaline ammonia solution (containing 2 percent sodium hydroxide, 5 percent monoethanolamine and 20 percent ammonia; it decontaminates sarin very well). The equipment is wiped down with rags soaked in the preparation cited. In the absence of decontaminants, chemical agents are removed with solvents (kerosene, gasoline, dichloroethane,etc.). Later, the treated rags are either burned or buried in the ground. After the vehicles are decontaminated, they are sprayed off with water, permitted to dry out and greased with lubricating grease or oil to prevent corrosion of metallic parts. When wiping down the equipment with rags, the decontaminant expenditure norms are 1-1.5 l/square meter.

Equipment is disinfected with solutions of water and calcium hypochlorite, bleaching powder, formaldehyde, Lysol, monochloride of iodine and others. The methods of disinfection are the same as for decontamination.

## Decontaminating the Territory of Livestock Farms and Livestock Facilities

The work connected with decontaminating an area requires a large expenditure of manpower and equipment. For example, to decontaminate territory with an area of one hectare, at least 10 tons of a decontaminating solution are required. Therefore, not all the territory of a farm and not all the buildings and structures are decontaminated but only that part upon which people will live and work and where animals and food stores will be located. The remaining sections of the area are marked with special warning signs and left to decontaminate on their own.

Depending upon the contaminating factor, the decontamination of territory, fodder, food, water and various articles is called //radioactive decontamination, chemical decontamination, disinfection.//

/Radioactive decontamination/ is the removal of radioactive substances from the surfaces of various objects and also from food products, fodder and water. In all cases, the goal of decontamination is to bring the radioactive contamination down to the permissible amounts. With the /mechanical/ method of decontamination, radioactive dust is removed from the surface of objects by sweeping, shaking and washing with water; in addition, effort is also applied to remove the contaminated layer of land or snow, to filter water, etc. The /chemical/ method of decontamination consists of dissolving the radioactive dust or changing the radioactive isotopes into complex compounds and subsequently removing them with a particular solution. A /physico-chemical/ method of decontamination is also used; various decontaminating solutions are used for this purpose.

Hard surface roads and sidewalks are washed with water (under a pressure of 3-5 atmospheres), using 3 l of water per square meter of surface. Dirt roads are replowed or their upper layer is removed with a scraper. Livestock facilities are decontaminated by washing away the radioactive substances with a strong stream of water. Washing away the radioactive substances begins with the roof and then the walls, doors and windows are decontaminated; the stream of water should be directed at the surface of the facility at an angle of 30-40 degrees. Brushes and brooms on long poles can also be used when washing down the walls and roof. The radioactive contamination removed from objects must be buried. When cleaning livestock facilities, trenches and holes are dug to absorb the water contaminated by the radioactive substances; when the decontamination is completed, they are covered up with dirt. After sprinkling the floor with water first, the decontamination of the inside of livestock facilities begins by mechanically cleaning the rubbish and manure out of them. Rubbish and manure contaminated by radioactive substances cannot be burned; they are taken out to specially allocated areas and buried at a depth of at least 70 cm. The walls, partitions and floors in the stalls or aisles are thoroughly washed and the water is collected along the drainage ditches in specially dug holes which are filled with dirt later. Articles used for tending animals (feed troughs, buckets, etc.) are washed down with water; brushes are used for this purpose. Household soap, soda, lye or surface acting agents (OP-7, OP-10) in a 0.3 percent concentration are used for more complete decontamination.

It is recommended that the following solutions be used to decontaminate individual protective gear and items used to tend animals: 1) a summer decontaminating solution (SD)--a 0.3 percent solution of water and OP-7 or OP-10 in a 0.7 percent solution of sodium hexametaphosphate; 2) a summer decontaminating acid solution (SDA)--the same ingredients with the addition of 2 percent hydrochloric acid and 0.1 percent of ABP-5 (amino-butane polymer) rust inhibitor; 3) a winter decontaminating acid solution (WDA) which includes the same components as the SDA solution but calcium chloride or magnesium chloride is included instead of the sodium hexametaphosphate to lower the freezing point.

The leather parts of harnesses are wiped with a damp cloth (oakum) and the felt and rope parts are shaken out. Clothes, smocks and special underwear are shaken out and then, when necessary, washed in a detergent solution according to special procedures.

/Chemical decontamination/ is the decontamination or removal of chemical warfare agents. The methods of decontamination are: //mechanical,// where the contaminated layer of the ground, snow, fodder or produce is removed or the contaminated area is sealed off; //chemical,// where the chemical warfare agents are neutralized or destroyed by chemical agents; //physical,// where the chemical agents are destroyed by high temperatures, removed by solvents or evaporated by airing; //mixed,// where the methods named above are combined.

Roads and passages to facilities contaminated by chemcial warfare agents are decontaminated in the following manner: 1) the contaminated area is sprinkled with bleaching powder (1 kg of bleaching powder per square meter of surface); it is subsequently plowed up to a depth of 3-4 cm and again sprinkled witn bleaching powder. When the area is weakly contaminated, bleaching powder is sprinkled on it and then water is poured on it 20-30 minutes later (when there is a wind, the water is poured on first and then the bleaching powder is sprinkled on it); or 2) the upper 10-cm layer of the ground (20-25 cm layer of snow) is removed; or 3) the surface of the ground is covered with sand or manure (at least a 10-cm layer) and a cover is made of boards, sheets of plywood, branches, etc.

Facilities are decontaminated with a 10-20 percent solution of bleaching powder or a 5 percent solution of sodium sulfite. Calcium hypochlorite or unslaked lime can be used instead of the bleaching powder. When the air temperature is lower than + 5 degrees, sulfuric chloride, or a warm 5-10 percent solution of sodium hydroxide or a 10-12 percent solution of ammonia water is used.

A 1-1.5 l/square meter solution of decontaminant is required to decontaminate buildings and structures contaminated by mustard gas and a 1.5-2 l/square meter solution is required to decontaminate buildings and structures contaminated by sarin and binary gases. When decontaminating soil with the powder of 2/3 the basic salt of calcium hypochlorite or with bleaching powder, their expenditure norms are 0.5-1 kg/square meter; at the same time, 4 l/square meter of water is required to wet down the soil. If wooden surfaces have been subjected to the effect of chemical warfare agents for a long time, it is possible for them to "sweat out" the chemical agents after their decontamination. Therefore, it is necessary to repeat the decontamination. Inside facilities, decontamination begins with the walls, feeding troughs and floors; then the rubbish and manure is cleaned up and the floors are cleaned again. The manure and rubbish are burned or taken to specially allocated places for burial. Metallic objects (buckets, pitchforks, spades, etc.) are decontaminated by firing, by boiling them in a 1-2 percent solution of lye for 2 hours or by wiping them with solvents 2-3 times. After boiling, the articles are washed down with clean water. Wooden objects (troughs, feeding troughs, tethering posts, etc.) are decontaminated with a paste of bleaching powder or with solutions of decontaminating agents and subsequently washed with water (1.5-2 hours later). Wooden articles of little value are burned.

Pastures and hayfields contaminated by chemical agents are marked with warning signs. The possibility of using them after they have been decontaminated on their own is decided based on the results of laboratory studies of material taken from the contaminated places. A reliable method of decontamination is burning the vegetation while observing fire safety measures.

//Disinfection// is the destruction of agents of infectious diseases in the external environment. The possible methods are: //chemical// where the microorganisms are killed with chemical preparations; //physical// if they are destroyed by high temperatures, gamma rays or ultrasonic sound; and also, //physicochemical,// where, for example, the effects of high temperatures and the steam from Formalin are combined in a Formalin-steam chamber.

Livestock facilities and the territory adjoining them are disinfected in the following manner: the territory and then the facilities (cow barns, pig sties, stables, etc.) are first abundantly wetted down with the disinfectant solution; after this, a mechanical cleaning is conducted. Manure and rubbish are burned on the spot or at the livestock graveyard; when they are being taken away, a 1 cm layer of bleaching powder is sprinkled on the bottom of the vehicle and on top of them. Before loading, the interior surfaces of the vehicle sides are smeared with a bleaching powder paste. Then, every object being treated, without exception, is completely wetted down with solutions of disinfectants. The wooden and metallic articles used for tending animals, as well as items made from fibers, wool, tarpaulin and cotton, are disinfected by boiling them 30 minutes for vegetative types of microbes and 2 hours for the spore types. They can also be decontaminated in the Formalin steam chamber, as well as by soaking them in a disinfectant solution.

Articles made from leather, rubber and synthetic film are wiped 2-3 times with a disinfectant solution with 0.1-0.2 percent of an emulsifier (OP-7, OP-10 and others) added to it to soak them better; after disinfection, the items are dried out and leather articles are smeared with grease (ointment).

Facilities and equipment contaminated by spores of Siberian ulcers are treated 3 times at hourly intervals. During a single treatment, 1 l of solution is used for 1 square meter of area and, for spore types of microbes, 2 l are used. One of the following agents is used: a suspension of bleaching powder containing not less than 5 percent active chlorine; a 10 percent solution of formaldehyde (calculating 10 l of Formalin per 90 l of water); a 5 percent solution of monochloride of iodine; a 20 percent purified solution of the 2/3 basic salt of calcium hypochlorite. The solution is abundantly poured over the soil ( 10 l/square meter).

### Rendering Medical Assistance and Preventive Medical Assistance to Contaminated Animals

Animals with a slight case of /radiation sickness/ only require good care, sound nourishment and veterinary observation. The appropriate medicines are used in the event their condition worsens. In extremely bad cases of radiation contamination, it is not advisable to treat animals; they are slaughtered for meat or to be used for commercial purposes. With a bad case of radiation sickness, only highly productive animals should be treated. Animals with an average case of radiation sickness are primarily subjected to treatment. In these cases, the treatment is always comprehenisve and it is directed at preventing infectious complications and at normalizing the functions of producing blood, the circulatory and digestive organs and the endocrine and central nervous systems. A great deal of attention should be devoted to maintaining and feeding sick animals. They are placed in dry, clean, well-ventilated facilities. Nourishment which is not sound and timely, disturbances, overheating or overcooling cattle and also poor conditions for maintaining them draw out the period of radiation sickness.

The rations are made up of sound, good quality feed. Animals are given leguminous plants or mixed hay, good silage, ground root crops, bran, ground grain and mineral additives. When using straw, it must be steamed and fed with the bran. Feed should be given 3-4 times a day in small portions. Vitamin therapy has a good effect on animals. Therefore, from the first days of the illness, it is recommended that the rations include herbal flour, 200-300 g of coniferous flour, germinated grain and, in the summer, green leguminous plants and cereal grains. When their situation is bad, animals are given concentrations of vitamins, C, K and B complex, especially $B_{12}$ (the daily dose of vitamins is increased by a factor of 2-3).

/When there is internal contamination by products of a nuclear explosion/, adsorbents, bonemeal or barium sulfate are given in normal doses by mixing them with a double amount of water to eliminate these products from the intestines and to reduce their absorbtion by the blood. Adsobar--barium sulfate with a thoroughly adsorptive surface--provides the best effect. Activated carbon (200-300 g) or kaolin and water can also be used. A laxative--sodium sulfate decahydrate in normal doses--is given 20-60 minutes after their introduction. Potassium iodide is used to reduce the build-up of radioactive iodine in the thyroid gland. Large animals are given 2.5 g of it and small animals are given 0.25 g.

/For beta contamination of the skin,/ measures directed at eliminating pain, arresting the development of inflammation, speeding up the regenerative processes and preventing the development of infection should be conducted as soon as possible.

/For contamination/ of animals by //organic phosphorous// chemical warfare agents, the symptoms are treated after the introduction of antidotes. Recovery usually sets in 3-7 days later.

For animals contaminated by //prussic acid// or //cyanogen chloride,//--after using amyl nitrite--it is necessary to inject a 1 percent solution of methylene blue prepared in a 25 percent solution of water and glucose into the vein and, without taking the needle out of the vein, a 30 percent solution of sodium hyposulfate must be injected (100-200 ml of both for large animals and 10-20 ml for small animals). If both preparations are not available, one of them is injected.

When animals are contaminated by //mustard gas//, a bandage with a 2 percent solution of chloramine is put on the contaminated skin and then a bandage with a penecillin ointment or with a reversible emulsion of sulfa drugs. reduce the resorptive effect, a 30 percent solution of sodium hyposulfate (150-200 ml for large animals and 20-40 ml for small and young animals) is introduced intravenously. Subsequent treatment is for symptoms. Symptoms are treated for internal contamination.

For contamination by //lewisite//, a 10 percent solution of (monotyol) in 5 percent glucose is injected in the vein or under the skin as an antidote (150 ml for large animals, 35 ml for young cattle, 15 ml for sheep, hogs). The antidote is injected four times on the first day after the contamination by lewisite, three times on the second day and two times on the third through the fifth days.

For contamination by //phosgene,// measures are taken to prevent emphysema. Oxygen is injected under the skin for the oxygen shortage which develops (3-5 l for large animals and 0.5 l for small animals).

### Procedures for Slaughtering and Conducting a Veterinary Medical Examination of the Meat of Animals Subjected to the Effects of Weapons of Mass Destruction

Animals are grouped into exclusive groups according to the type, nature and degree of injury (contamination) and also according to the deadlines for slaughtering. They are slaughtered with their respective groups at a sanitary slaughter house or in the general shop of a meat combine after healthy animals are slaughtered or they are slaughtered at field slaughtering points which are specially set up. At this point, it is necessary to have: a derrick crane to prepare the carcasses--the crane is equipped with a hoist which is set up over a hole covered by a lattice flooring; a rack for the organs and carcass half; a table for scraping and salting the hides and a table for getting rid of the contents of the intestines and stomach; a barrel for pickling the raw intestines and a container for water; a wheel barrow and light instruments. A pit for the contents of the stomach and intestinal tract and for confiscates (rejected organs or parts of organs) is dug 5-10 m from this point. With a single derrick crane, 20 head of cattle can be slaughtered and processed during a 10-hour period. In all cases where contaminated animals are slaughtered, when removing the hide and innards, measures are taken to prevent the possibility of contaminating the carcass with the wool and the contents of the stomach and intestinal tract.

/For contamination by nuclear weapons./ Animals with pronounced clinical symptoms of radiation sickness, with a high body temperature, with skin contaminated by radioactive substances higher than the permissible amounts and those which have not gone through a veterinary inspection cannot be slaughtered for meat.

//When there are multiple injuries// from the shock wave, heat radiation and radiation, animals are slaughtered and a veterinary medical inspection of the carcass and organs is conducted with due regard for the injury (trauma or burn) which has caused the greatest pathological changes which have an effect on the medical and hygenic indices for the meat. With widespread burns on the skin (third degree burns over an area of at least 5 percent of the body's surface), animals should be slaughtered for meat within the first four days after the injury since microbe seeding of the tissues can take place later; in connection with this, these carcasses must be subjected to bacteriological and biochemical studies.

//With recent injuries and broken bones,// animals can be slaughtered for meat if there are no local inflammations and if the body temperature is normal. In these cases, only the tissues permeated by blood and swollen tissues are removed. If inflammations, inflammation in the blood flowing to the lymph nodes and also indications of putrefaction are detected in the injured areas, bateriological and biochemical studies of the carcasses are conducted after the animals are slaughtered.

//With gamma irradiation// of animals in doses which cause bad and extremely bad cases of radiation sickness, they are sent for slaughter. If they are killed during the first 3-12 days after irradation, i.e., before a pronounced clinical picture of radiation sickness has developed, then, in the absence of pathological changes, the meat is used without any restrictions. In these cases, a veterinary medical inspection of the internal organs is conducted in accordance with existing regulations.

//With internal radioactive contamination// in doses which cause serious injuries, animals can be slaughtered for meat until pronounced clinical symptoms of illness develop. These animals are usually killed between the 6th and 12th days after radioactive substances have stopped entering the body. During this period, the level of radioactivity in soft tissues decreases by a factor of 10 or more and pronounced clinical symptoms of illness may not appear. With internal contamination by the early radioactive substances of a nuclear explosion, animals can be killed for meat during the first days after contamination; at this time, the thyroid gland and the major packets of lymph nodes are removed and destroyed.

Measurements are taken of the level of radioactivity in the carcasses and other slaughter products obtained from contaminated animals. The results of the veterinary medical evaluation depend upon the concentration of radioactive substances in them. If the content of the latter exceeds the permissible concentration, the carcasses and other slaughter products are put in storage. The more junior the products of the explosion which have entered the animal's body and the sooner the animal is killed after they have entered its body, the quicker the concentration of radioactive substances in the carcass and other products will decrease during storage.

With internal contamination of animals by radioactive strontium, slaughter products are produced depending upon the concentration of this radioactive isotope in them and depending upon the hygienic medical quality of the meat.

/With contamination by posionous agents./ In the absence of antidotes or with a fatal contamination by mustard gas and asphyxiating chemical agents, it is more advisable to slaughter the animals for meat. For this purpose, the procedures for a preslaughter inspection of them and a a postslaughter examination of the slaughter products must comply with existing regulations.

When the technical resources are present, all contaminated animals, regardless of the type of chemical agent, are killed during the first two hours after contamination. If these conditions do not exist, the following priority order is established for slaughtering contaminated livestock.

Animals contaminated as follows are slaughtered in first priority: a bad case of contamination by organic phosphorous chemical agents with a developed clinical picture of posioning and also in cases where their death has been postponed by the introduction of antidotes; a serious case of contamination of the skin by nitrogen and sulfuric mustard gas with the appearance of pronounced disturbance, convulsions, swelling of the skin in the contaminated spot and interruption of cardial activity; average and light cases of contamination by lewisite; and bad cases of contamination by nerve and paralyzing gases. Animals contaminated by the following are slaughtered in second priority: an average case of contamination by organic phosphorous chemical agents; a bad case of contamination by sulfuric mustard gas through the respiratory organs, digestive organs and skin; a bad case of contamination by phosgene. In third priority, animals not actually in danger of dying (slight posioning) are slaughtered for meat. They are killed when necessary for meat.

Animals with a bad case of lewisite contamination (they are treated with an antidote and, in the absence of the latter, they are destroyed and buried in the ground) as well as those in a state of agony are not slaughtered for meat.

Animals with average and slight cases of lewisite contamination which were not killed during the first two hours after being contaminated can be slaughtered no sooner than 12-14 hours later since arsenic accumulates in the muscles during the 2-8 hour interval after contamination. In the future, its content gradually decreases but it can be preserved in the organs up to 25-30 days. Therefore, meat obtained from animals contaminated by lewisite must be studied for arsenic content (the natural content of arsenic in meat is not greater than 0.5 mg/kg).

During the medical evaluation of meat, guidelines are provided by the results of the veterinary medical examination of the carcasses and organs with due regard for the data from the preslaughter inspection.

Meat is produced without any restrictions: 1) after maturation when contaminated by organic phosphorous chemical agents (regardless of the means of contamination) if the animal was killed during the first two hours after the clinical picture of posioning developed; when slaughtering livestock contaminated by binary gases, the meat must be studied for its posion content which must not exceed the maximum permissible norms; the internal organs from animals contaminated by organic phosphorous chemical agents are sent for commercial salvage; 2) when there is limited contamination of the skin by mustard gas or lewisite (individual droplets of the chemical agent) or when only the lower parts of the limbs are contaminated; in these cases, the contaminated spots on the carcasses are trimmed off and the contaminated parts of the limbs are removed and sent for salvage; 3) when animals are contaminated by mustard gas through the respiratory organs and when they are slaughtered during the first 6-8 hours and also when they are contaminated through the digestive organs if the animal was slaughtered not later than 12-14 hours from the time of its contamination; in these cases, all the internal organs and the head are sent for salvage; 4) in the event animals are contaminated by asphixiating chemical agents and when clinical signs of beginning emphysema are present, all the internal organs are sent for commercial salvage.

Meat is condemned and sent for commercial processing or destroyed: in case of very serious contamination of animals by mustard gas through the respiratory or digestive organs; when a large area (more than 1/3 of the surface) of the skin is contaminated and when the animal is already in a bad overall condition during the first hours of posioning; when it is neccessary to trim away a part of the carcass which exceeds 50% of its surface; when binary gases are detected in the meat above the permissible limits; when microflora have seeded the meat which prevents its utilization as food.

The hides of animals contaminated by persistent chemical agents are removed from the slaughtering sites and subjected to decontamination and preservation.

/With contamination by biological agents./ When determining the possibility of slaughtering animals contaminated by biological agents for meat, the type of agent, its form of employment (aerosol, powder, etc.), the duration of the animal's exposure in the center of contamination, the time for conducting veterinary treatment and nonspecific or specific preventive measures, as well as the animals' susceptibility to an agent of this type (or to agents of these types) are taken into consideration. Animals subjected to biological contamination are not permitted to be slaughtered for meat: until the type of agent or toxin employed by the enemy is established; if they have not gone through veterinary inspection and veterinary treatment after being subjected to contamination by an agent or the toxin of botulism; if sick or suspected of being sick with Siberian ulcers, melioidosis, rabbit fever, cattle plague, African swine flu, camel plague, poultry plague and ornithopsittacosis as well as with illnesses not encountered in the Soviet Union. For other infectious diseases, guidelines are provided by the appropriate regulations for veterinary inspection of animals and for veterinary medical examination of meat and meat products.

All persons conducting veterinary treatment, preslaughter inspection, slaughter of animals and preparation of carcasses must comply with individual preventive measures. Smoking, drinking and eating are forbidden during work. When the slaughter of animals contaminated by biological agents is completed, slaughter houses, slaughtering points and slaughtering areas are subjected to mechanical cleaning and disinfection. All instruments, equipment, tools and overalls as well as drainage water are decontaminated. Operating personnel go through a personal cleansing.

## 5. Protecting Plants Against Weapons of Mass Destruction

A number of organizational, agrochemical and other measures are conducted in peacetime to protect plants against weapons of mass destruction. An especially large amount of attention is devoted to preventing the spread of agricultural crop diseases and pests. Appropriate breeding work is also conducted to develop plant types which are immune to diseases and ionizing radiation. Measures are conducted to improve soil fertility and quarantine measures are carried out.

### CD Measures When Plants Are Contaminated by Herbicides

Facility CD chiefs and the appropriate specialists of the plant protective services organize all the measures for protecting plants against weapons of mass destruction. The practical work is accomplished by the manpower and equipment of the kolkhozes, sovkhozes, mechanized detachments of the Argricultural Equipment Association and plant protection stations. After establishing the fact that the enemy has employed chemical agents, the kolkhoz (sovkhoz) agronomist and the phytopathological reconnaissance team thoroughly examine all the farm's fields and, using visual and quick methods, they determine the type of herbicide (defoliant, desiccant) and they also take samples for a laboratory analysis and determine the boundaries of the contamination. A record or report is compiled based on the results of the examination of the agricultural area. One copy of the report is sent to the staff of the rayon's plant and animal protective service and, along with the samples taken (plants, clippings), the second copy is sent to the agrochemical laboratory (the plant protection station, scientific research institute).

After determining the type and dose of the herbicides which have settled on the plants, the farm agronomist forecasts the possible level of plant contamination with due regard for their developmental stage, weather conditions and also possible crop losses or plant deaths; after this, he outlines a plan of measures to save the harvest. When young crops are contaminated by herbicides to a slight degree where possible crop losses do not exceed 30 percent of $ED_{30}$*, thorough and increased care of young crops is required. Mineral supplements are given, cultivation is carried out between the rows, additional watering is conducted, etc. The grain harvested from these fields is only used for food with the permission of the medical service and it is used for feed for livestock only with the permission of veterinary specialists after they have determined the remaining amount of herbicide in it. When using mineral fertilizers for supplementary plant feeding, it should be borne in mind that supplementary feeding of young cotton plants and other dicotyledons with nitrogen fertilizers will increase the toxicity of the herbicide during the first 1-2 weeks after the employment of 2,4-D [2,4-dichlorophenoxyacetic acid] or 2,4,5-T [2,4,5-trichlorophenoxyacetic acid].

When there is an average level of contamination of young crops (50-70 percent reduction in the harvest), depending on the farm's economy and its equipment resources, the plants can be plowed up and the fields can then be sown again with crops which are immune to the given herbicide or the contaminated crops are left for harvesting when mandatory measures are conducted to reduce the harmful effect of the herbicide. The harvest obtained from these areas is used as food for people or as feed for livestock after the amount of herbicide remaining in it is determined. The seeds of oil producing corps (sunflowers, castor plants) which are obtained from fields which have an average level of contamination by 2,4-D, 2,4,5-T preparations are processed

* $ED_{30}$--the effective dose which, when employed will reduce the harvest by 30 percent.

for commercial purposes. The seeds of dicotyledons from these fields should not be stored since they are distinguished by a low capacity for germination.

When a high level (90-100 percent of the harvest perishes) of the young crops are contaminated, the plants are, as a rule, destroyed. When the plants are not very high, the field is plowed over; when the plants are high, they are mowed, taken beyond the boundaries of the field and burned and the field is plowed over. With a high level of contamination of dicotyledons (sunflowers, leguminous crops, vegetable crops) and fodder grasses with the 2,4-D, 2,4,5-T preparations, it is recommended that they be mowed quickly and put into silage and it is recommended that the areas be plowed over. During the silage process, the herbicides cited decompose without interfering with the microbiological process which takes place when the mass is ground. The silage will also be suitable for feeding livestock.

Chopping--i.e., removing that part of the stalk which has the deformed leaves (up to 1/3 of the stalk)--is one of the methods for saving cotton plants contaminated by preprations of the 2,4-D type. Chopping speeds up the formation and development of additional shoots and it speeds up the formation of fertile branches on them with bolls. It is effective when the plants are in the stages of having 4-5 actual leaves and before budding begins, with the condition that they are contaminated by herbicide to a slight or average degree (crop losses up to 40-70 percent). It is not very effective when conducted during the later phases of cotton plant development (in the event a herbicide has been employed) and also when plants have been contaminated to a severe degree.

It should be borne in mind that, when the harvest is reduced by 50 percent as a result of the employment of a herbicide, the commercial quality of the remaining cotton fiber and seeds is sharply reduced. The fiber will be fourth rate and the seeds will be third class. When 70 percent of the harvest is lost, the fiber changes to fourth-fifth grade and seeds are not rated.

Regardless of the herbicide dose (paraquat, picloram, dimethylarsinic acid), animals are not permitted to graze on contaminated pastures and grass contaminated by herbicides is not permitted to be mowed and fed to animals. Within these areas, water cannot be taken from open sources to drink, to use for nutritive purposes and to water animals without the permission of the medical and veterinary services.

/Using contaminated land./ During the year a herbicide is employed, plowed-up fields can be used for sowing winter or early-ripening spring food and fodder crops which are immune to the preparation employed by the enemy. Thus, grain crops, primarily corn, can be cultivated on land contaminated by picloram and it is recommended that winter crops be sown in fields contaminated by paraquat.

During the first several years, land contaminated by dimethylarsenic acid or by its preparations cannot be used to grow food and fodder crops since the harvest may contain an increased amount of arsenic. These areas can be used for commercial crops which are not used for food or feed.

CD Measures When Plants are Contaminated by Biological Agents

When the fact has been established that biological agents have been employed, it is necessary to establish the type of agent and carry out an examination of all the fields. During the examination process, the boundaries of contamination, the density of the spores per square meter, the degree of initial contamination of each field and the possibility of an epiphytic condition developing are established.

When the uredospores of //grain rust// are detected in the air or on crops, the possibility of the parasite growing in the fields is determined and deadlines and a priority order for treating fields with fungicides (cinebe, polycarbacene, manebe and other dithiocarbamates as well as nickle salts, ground or collodial sulphur, etc.) are planned. It is most advisable to use cinebe (a damp gray or yellowish gray powder containing 50 to 90 percent of the active ingredient--zinc biethylenedithiocarbamate [$(CH_2NHCSS)_2Zn$]) and polycarbacene (the complex of the zinc salt from biethylenedithiocarbamic acid and polyethylenethiuramdisulfide; it is manufactured in the form of a 75-80 percent damp powder). For successful control of grain rust, it is very important to determine the time when the fields should be treated with fungicides.

> The time for the most effective employment of fungicides is determined in the following manner. The first treatment is conducted upon detecting the agent for stem rust in the air or on crops in an amount capable of causing an epiphytic condition if the weather favors it. The possible contamination of wheat is analyzed further and the cycle for the first uredogeneration of the fungus is determined. If there was a dew or if it had rained in the 6-8 hour period while the

spores were settling down, and if the air temperature did not drop lower than + 10-12 degrees, then the spores which settled on the plants will grow and contaminate the wheat with rust.

The cycle for growing the first uredogeneration of the fungus depends on the temperature: the higher it is the quicker the growing cycle will end. For its completion, it requires a sum of effective temperatures which equals 125 degrees for wheat stem rust and it requires a minimum temperature equal to + 2 degrees for the parasite's growth. Proceeding from this, the cycle for developing the first uredogeneration is cacluated according to the formula:

$$\Pi = \frac{C}{T-t},$$

where $\Pi$ is the cycle for growing the generation (in days); C is the sum of the effective temperature; T is the average daily air temperature; t is the lower temperature threshhold for growing the fungus (equal to + 2 degrees).

| Дата 1 | 2 Температуры (градусов) | | | Дата 1 | 2 Температуры (градусов) | | |
|---|---|---|---|---|---|---|---|
| | среднесуточная 3 | эффективная $T-t$ 4 | сумма эффективных температур 5 | | среднесуточная 3 | эффективная $T-t$ 4 | сумма эффективных температур 5 |
| 21.05 | 20 | 18 | 18 | 25.05 | 20 | 18 | 86 |
| 22.05 | 18 | 16 | 34 | 26.05 | 18 | 16 | 102 |
| 23.05 | 16 | 14 | 48 | 27.05 | 16 | 14 | 116 |
| 24.05 | 22 | 20 | 68 | | | | |

Key: 1. Date
2. Temperatures (in degrees)
3. Average daily
4. Effective T-t
5. Sum of effective temperatures

Example. The spores are detected on 20 May. The average daily temperature was equal to 18 degrees; there was dew on the plants throughout the entire night and they were contaminated. The subsequent course of the temperature:

According to this data, the appearance of pustules of rust should be expected on 28 May. This means that it is necessary to spray the crops with fungicides before the massive development of uredopustules and before the uredospores of the fungus are scattered, i.e., not later than 28-29 May.

The deadlines for subsequent treatments of the grain with fungicides are determined in the same manner.

Cinebe or polycarbacene suspended in water with an expenditure norm of 4 kg per hectare (for the active ingredient) are used for chemical treatment of fields against rust. The suspension is sprayed on the fields from an airplane equipped with a boom sprayer or from a helicopter equipped with a boom sprayer with a centrifugal whirling diffuser and also with ground-based sprayers.

The suspension is prepared before use; crops are treated with it in the morning (before 1000-1100 hours) or after 1800 hours. The treatment is conducted 2-3 times: the first time is immediately after it has been established that the enemy employed spores of the rust fungus; the second time is during the 1-3 day period before the first generation of the fungus has finished growing. When necessary, the third treatment is before the second generation is finished. At the same time, uncontaminated territory is also taken in. Measures are taken at the same time to eliminate the intermediate host--the barberry bush.

To control //phytophthora infection// of potatoes, the tops of the plants are sprayed with fungicides combined with supplementary leaf-feeding of phosphorous and potassium. For these purposes, a mixture of Bordeaux insectcide, calcium chloride and superphosphate extracts is used. The Bordeaux mixture (a solution of copper sulfate and unslaked lime) is prepared according to special methods. Then, two parts of a 7.5 percent solution of superphosphate extracts in water are taken, about 1.5 percent of calcium chloride is added and everything is mixed with one part of a 3 percent Bordeaux mixture of a neutral reaction. The working solution is used in the freshly prepared form. Due to the difficulty in preparing the Bordeaux mixture, cinebe or copper oxychloride (50 or 90 percent copper oxychloride and the rest--filler) is usually used. The expenditure norm per hectar for one treatment of both preparations is 2 kg of the active ingredient.

The first fungicide treatment of potato plants is accomplished immediately after the fact is established that the plants are contaminated and not later than the day of the initial appearance of the disease. The deadlines for subsequent treatments are determined by the agronomists based on the length of time the fungicide's activity is preserved on the plants and based on the synoptic weather forecast for the given area. The minimum and maximum temperature, the sum of the effective temperatures, the incubation cycle for growing the fungus and the presence of precipitation are taken into account.

Cinebe and the Bordeaux mixture are used to eliminate rice //piriculariosis.// Only measures which increase soil fertility and breeding work are conducted as measures for controlling //cotton plant wilt.//

/Tending agricultural crops./ It is recommended that cereal crops be given supplemental leaf-feedings of potassium (8-16 kg/hectare and phosphorous and potassium (8 kg of potassium chloride and 7 kg of superphosphate per hectare), especially during the tuber period. Supplemental crop watering is resorted to in irrigated land during the tillering and tuber stages. Contaminated vegetation is destroyed. Potato and beet crops receive supplemental cultivation between the rows and additional fertilizer.

When /harvesting crops,/ it is important to prevent contamination of seed material.

## CD Measures When Plants are Contaminated by Radioactive Substances

For all practical purposes, it is impossible to protect plants in the field from the casualty producing factors of a nuclear explosion, including radioactive substances. Only small areas can be covered with film. Therefore, in the event the enemy employs nuclear weapons, the basic measures in growing plants will be directed at reducing the damage caused by radioactive fallout and at decreasing the entry of radioactive isotopes into plant tissues, especially into the economically useful part of them.

The radioactive products of a nuclear explosion can settle on fields //before sowing.// In this case, the soil is contaminated and, therefore, deep plowing--by completely turning the furrow over--should be conducted in all fields designated to be sown with winter and spring crops in zones C and B of the path of the radioactive cloud. As a result of this plowing, the upper, contaminated layer is put on the bottom or the furrow.

Subsequently, shallower plowing is conducted in order not to raise the radioactive soil to the surface.

When nuclear warheads are exploded during //the plant vegetation period,// not only the soil but also the vegetative cover is contaminated by radioactive substances. This kind of situation can arise when the path of the radioactive cloud is being formed during above and below ground nuclear explosions (local radioactive fallout) and also during the period of intensive, worldwide radioactive fallout (tropospheric and stratospheric fallout) which can occur over a period of 2-3 years. In these cases, a system of protective measures directed at saving crops and decreasing the radioactive contamination of the products of plant growing is employed.

Finally, over a period of many years, the soil will contain isotopes with a long life (strontiam-90, cesium-137 and others) which migrate from the soil to the plants. In these situations, a system of measures directed at reducing the transfer of radioactive substances into the underground part of plants and root crops is conducted.

### CD Measures for Reducing Crop Losses and Surface Contamination of Agricultural Produces by Radioactive Substances

Growing vegetable and berry crops and fruit and citrus trees in protected ground (greenhouses, hothouses, hot beds) is the ideal measure for protecting plants against radioactive fallout. In our country, a great deal of attention is devoted to greenhouse farming for the purpose of supplying the population with fresh vegetables and berries the year round. Large greenhouses are being built at the sovkhozes near cities.

> Thus, the area of greenhouses at the capital's Moscow Sovkhoz Combine is 64 hectares. During the year, the combine produces 16,000-18,000 tons of vegetables.

During the period of a threat of an enemy attack, small areas of vegetable crops, tea plantations and citrus groves can be covered by film. For this purpose, 1.5 tons of polyvinylchloride film is required per hectare of area and labor expenditures for covering it will be 20 man-hours.

During the period of intensive, worldwide radioactive fallout, it is recommended that more food crops whose grain is covered by folds or scales (legumes, oats, rice, millet, buckwheat, corn) be cultivated. The seeds of sunflowers, flax and hemp are protected against surface contamination by radioactive substances. Until a lot of radioactive substances build up in the soil, the tubers of potatoes are also protected against local contamination by the soil.

The magnitude of the surface contamination of plants by radioactive substances depends upon the form of the leaves, the presence of ridges on them, etc. and also upon the stage of plant growth when the radioactive dust settled (Table 33).

Table 33. Strontium-90 Content of Grain and Chaff During Surface Contamination of Wheat Crops by an Isotope During Various Stages of Growth

| (1) Фаза развития, в течение которой произведено загрязнение посевов | (2) Содержание стронция-90 (% от выпавшего на посевы) | |
|---|---|---|
| | (3) в зерне | (4) в соломе |
| (5) Кущение | 0,002 | 0,4 |
| (6) Выход в трубку | 0,02 | 6,1 |
| (7) Цветение | 1,5 | 25,6 |
| (8) Восковая спелость | 1,8 | 34,5 |

Key:
1. Stage of growth during which crops were contaminated.
2. Strontium-90 content (percentage of what fell on crops)
3. In the grain
4. In the chaff
5. Tillering
6. Putting out tubers
7. Blooming
8. Golden ripeness

The less time that passes from the day of radioactive contamination of crops until the harvest is gathered in, the greater the amount of radioactive substances that will be contained in the harvest of agricultural crops. During plant vegetation, their level of radioactivity decreases as a result of the natural decay of radioactive substances, radioactive dust being washed off by precipitation, radioactive dust being blown off by the wind and as a result of old leaves falling off. When crops are watered with sprinkling systems, a significant part of the radioactive dust is washed off the plants.

/Tending agricultural crops./ The process of tending crops is changed for purposes of reducing crop losses. In order to plan measures for tending crops, a field dosage map should be drawn up. For this purpose, it is necessary to obtain data on the time of the nuclear explosion, the beginning and end of local radioactive fallout and the maximum levels of radiation in various fields. The levels of radiation in all the fields are cited for a single, specific time (for 1 hour or 10 hours after the explosion, etc.); after this, the appropriate values for the radiation levels are posted on the field map (Figure 65). Then, the radiation dose which vegetating plants will receive during a 4-day period or until the end of the vegetation period is estimated (see Table 45 on p 245). Using the data in Table 11, probable crop losses are calculated based on the size of the radiation doses. Based on these calculations, the radiation situation which has developed in the fields, meadows and gardens is evaluated and measures are planned for tending crops and for saving, gathering and using the harvest.

If the radioactive dust fell on the fields when the crops had already ripened, then, given a timely harvest, it will not have any effect on the size of the harvest. However, the grain obtained may lose its germinating capacity from the effect of ionizing radiation. In addition, the grain may crumble and, in dry weather, root crops may rot if the harvest cannot be done in a timely manner due to the high level of radiation in the fields for these crops. For example, practically all the cereal crops in the stages of growth will perish in zone C; up to 50 percent of the crops may also perish in zone B.

If, according to the estimate, 50 percent or more of the harvest of vegetating plants will perish in a particular field, an end is put to tending the crops. The radiation levels will be high here. Based on radiation security conditions, when the opportunity presents itself, the cereal and leguminous crops in these fields are mowed for hay and the areas are again sown with early ripening crops or the soil is prepared for winter crops. The hay obtained from these fields is used for livestock after radioactive measurements are taken.

In fields where less than 50 percent of the crops perish, care for the crops is improved: plants are given supplemental leaf feedings; cultivation is conducted between the rows; the watering norms are increased; etc.

When plants are contaminated during early stages of growth by a dose which is 50 percent of the fatal dose, their growth and development are sharply arrested and, at the same time, the harvest decreases by approximately 60-70 percent. If plants are radiated by the cited dose after blooming, the harvest may drop insignificantly (up to 20 percent); however, the grain will not be suitable for seed purposes. It may lose its germinating capacity. The radiation of wheat crops by a 400 roentgen dose during the tillering and blooming stages will cause a 50 percent

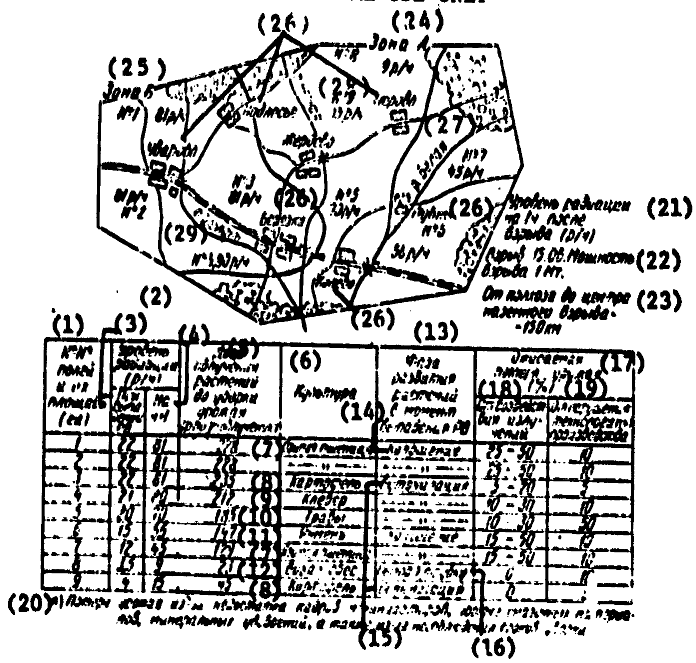


Figure 65. Field Dosage Map for Vanguard Kolkhoz and Possible Crop Losses after Radioactive Fallout

Key:
1. Field number and area (hectares)
2. Radiation level (roentgens/hr)
3. During fallout
4. By H + 1
5. Plant radiation dose by harvest time (field radiometer gamma radiation = radiation)
6. Crop
7. Winter wheat
8. Potatoes
9. Clover
10. Grasses
11. Barley
12. Vetch and oats
13. Stage of plant growth at the time of fallout
14. Tillering
15. Blooming
16. Putting out tubers
17. Expected crop loss (percent)
18. From radiation effects
19. From interruption of production process*
20. Crop losses due to a shortage of mechanics, POL, mineral fertilizers and also due to noncompliance with harvest deadlines.
21. Radiation level 1 hr after burst
22. Burst at 1506. Yield - 1 megaton.
23. From the kolkhoz to ground zero of the surface burst - 150 km
24. Zone A
25. Zone B
26. Hamlets
27. White River
28. Black River
29. Shelan' River

loss to the grain harvest; in this case, the grain which forms will completely lose its field germinating capacity. The radiation of wheat crops by a 200 roentgen dose during the same stages of growth will lead to a 30 percent loss of the harvest and to a 20-50 percent reduction in the grain's field germinating capacity. The radiation of 10-20 cm high potato shoots will lead to a 30 percent loss of the harvest and to a 30-50 percent reduction in the field germinating capacity of the potatoes harvested from these areas.

/Harvesting and using crops./ It is important to firmly establish the procedures and priority order for harvesting crops from fields depending on their level of radiation. Crops in fields with the lowest, safest levels of radiation for people are harvested first. While the crops are being harvested here, the level of radioactivity in the subsequent fields with higher levels of radioactivity will decline significantly. Thus, it is possible to gradually harvest all the crops from all the fields. Crops with different levels of radioactivity are stored separately.

In order not to permit secondary contamination of grain by the soil, it is recommended that grain crops be harvested directly by combines with a higher cut.

It is better to take the harvested crops away from the field immediately to granaries or vegetable storehouses or it is better to store them in an area prepared for this purpose and cover them with tarpaulin or film.

When harvesting crops on radioactive contaminated land, it is necessary to work in coveralls made of dense fibers and respirators and it is necessary to monitor people's radiation doses. To a certain extent, the produce harvested from these fields will be radioactive. Agricultural specialists are obligated to provide a skilled recommendation on using the crops. The nutritive qualities of grain, root crops, hay and straw are not changed by the effects of gamma rays and beta particles. They can only be unsuitable for food or fodder purposes due to radioactive contamination. With permissible levels of radioactive contamination, such horticultural produce is used for food and fodder purposes; when the radioactive content is higher than the permissible levels, the produce is decontaminated or sent for commercial processing (for alcohol, starch, sugar, oil).

6. Conducting Agricultural Production on Land with an Increased Strontium-90 Content

When the soil is radioactively contaminated, isotopes with a long life, such as strontium-90, cesium-137, ruthenium-103 and 106, promethium-147, cerium-144 and others build up in it. Strontium-90 is more active in the soil-plant link. In comparison with the other radioactive isotopes, it also presents the greatest biological danger. Therefore, in fields contaminated by radioactive substances, the appropriate measures are primarily conducted to reduce the passage of strontium-90 from the soil to the underground parts of plants or root crops.

The external boundaries of the zones of radioactive contamination are characterized by the following levels of strontium-90 content in a 5-cm layer of soil (in curies/square kilometer): zone A--0.2-0.5; zone B--3; zone C--10.

/Zone A./ It is more advisable for farms located on the periphery of the zone to be switched over to vegetable production. In this part of the path of the radioactive cloud, the strontium-90 content of the soil fluctuates from 0.2 to 1 curie/square kilometer; therefore, vegetables will contain a permissible amount of this isotope for use as food. In other areas where the strontium-90 content exceeds 1 curie/square kilometer, it will not be possible to obtain vegetables with the permissible strontium-90 content during the first years after a nuclear missile war. Obviously, during the first 3-4 years when there is intensive worldwide radioactive fallout, it will be altogether impossible to obtain any leafy vegetables (lettuce, sorrel, dill, parsley and others) from open ground since they will be badly contaminated by radioactive dust and it will be rather difficult to remove it from their surfaces. During the first years, these vegetables can only be grown in hot beds and greenhouses. With strontium-90 levels up to 2 curies/square kilometer on the periphery of zone A, it is possible to raise cattle on locally produced feed since the strontium-90 content in the milk will be within the permissible wartime limits.

In the middle of zone A and along its internal border where the strontium-90 content of the soil reaches 3 curies/square kilometer, it is more advisable to cultivate grain and leguminous food crops. Since the leguminous crops assimilate 4-5 times more strontium-90 from the soil than cereal crops do, it is recommended that they be sown in soils with a lower content of the isotope.

/Zone B./ It is more advisable to use the land in this zone to produce commercial crops (flax, hemp, cameline, sunflowers, castor, essential oil plants, cotton, sugar beets and others) as well as potatoes for starch or alcohol and grain crops for alcohol. Grain and leguminous crops can also be grown for seeds since the quality of the grain seeds does not change in this case. Fodder and root crops can also be cultivated here to feed meat and draft livestock. For the first time, the soil is plowed to the maximum depth.

Throughout the entire territory of zone B, meat and draft livestock, karakul sheep and sheep for meat and wool, wild animals and poultry (when kept in pens) can be raised on locally produced feed. Adult cattle, sheep and goats can be fattened up for meat with local feed when the level of strontium-90 in the soil is up to 10 curies/square kilometer and calves can be fattened with local feed when the level is lower than 5 curies/square kilometer. Only 2-4 weeks before slaughter, it is important to give them feed obtained from a zone with moderate radiation or from areas which were not subjected to local radioactive contamination.

/Zone C./ During the first year, measures are conducted here to reduce the strontium-90 content in the arable layer: with levels of strontium-90 contamination from 10 to 30 curies/square kilometer, deep plowing by turning over the furrow is conducted or plowing is conducted by transposing the soil layers (to a depth of 50-70 cm). Then, commercial crops are grown on the plowed land. Draft livestock can be kept on the feed produced in soil with a maximum strontium-90 contamination of 30 curies/square centimeter and hogs can be fattened for lard on grain produced in land with a strontium-90 content up to 100 curies/square kilometer. With the same content of the isotope in feed, the meat of hogs will contain 10 times less of it than the meat of cows and sheep.

It is advisable to raise meat and egg breeds of poultry in zones B and C. Nevertheless, when the egg laying period is over, poultry should be given clean feed before slaughtering them for meat.

A difficult situation develops in zones B and C for pond and lake fish breeding. The strontium-90 content in the bones of fish (perch, carp) will be an average of 3,000 times greater than the content in the water and the content in the muscles will be 5 times greater than in the water; the cesium-137 content in the muscles will be 3,000 (carp) and 9,000 (perch) times greater than in the water. The fish absorb 67-78 percent of the radioactive isotopes from the water and they absorb the remaining amount from the food they use. With a maximum concentration of $2.1 \times 10^{-9}$ curies/l of strontium-90 in the water, fisheggs begin to die and, with a concentration from $2.1 \times 10^{-12}$ to $2.1 \times 10^{-10}$ curies/l, deformities develop in larvae and young fish. With a concentration of $2.1 \times 10^{-8}$ curies/l (21 nanocuries) of the isotope in the water, the death of all the eggs and fish is observed.

Land with a strontium-90 content of up to 50 curies/square kilometer can be used for agricultural production; in exceptional cases, grain to fatten hogs for lard can be grown on land containing up to 100 curies/square kilometer of this isotope in the soil. In the remaining territory of this zone, it is impossible to grow plants during the first years. It is best to use this land to plant woods; pine trees whose central roots penetrate deeply into the soil are best.

When growing plants on land with an increased content of radioisotopes with a long life, it is recommended that special measures directed at reducing the transfer of the isotope from the soil into the plants be conducted.

### Basic Measures for Reducing the Entry of Strontium-90 into Plants from the Soil

The passage of strontium-90 from the soil into plants depends upon numerous factors which are characteristic of the quality and fertility of the soil. In addition, the physiological features of the plants play a significant role in this process. Crops which contain more calcium also draw more strontium out of the soil (Table 34). Thus, leguminous crops accumulate 2-5 times more strontium-90 than cereal crops. The least amount of strontium-90 is accumulated in the grain, leaves and stalks of corn. Approximately just as much strontium-90 is transferred from the soil to the tubers of potatoes and carrots as is transferred to the grain of cereal crops grown in the same field. Even different grades of the same crop do not accumulate the same amount of this isotope (Table 36).

Table 34. The Passage of Strontium-90 and Cesium-137 from Various Types of Soils into the Harvests of Several Crops over a 3-year Period (as a percentage of their total content in the soil; a laboratory experiment)

| (1) Механический состав почвы | (5) Овес | | (6) Горох | | (7) Клевер | | (8) Тимофеевка | |
|---|---|---|---|---|---|---|---|---|
| | $Sr^{90}$ | $Cs^{137}$ | $Sr^{90}$ | $Cs^{137}$ | $Sr^{90}$ | $Cs^{137}$ | $Sr^{90}$ | $Cs^{137}$ |
| (2) Глинистый песок | 16,2 | 0,8 | 26,0 | 0,1 | 43,9 | 1,5 | 17,1 | 0,9 |
| (3) Средний суглинок | 8,6 | 0,4 | 18,9 | 0.1 | 27,0 | 0,5 | 10,9 | 0,5 |
| (4) Тяжелый суглинок | 3,1 | 0,1 | 7,6 | 0,01 | 14,3 | 0,4 | 3,8 | 0,2 |

Key:

1. Soil texture
2. Clayey sand
3. Average loam
4. Heavy loam
5. Oats
6. Peas
7. Clover
8. Timothy

It is recommended that the following agrochemical and agrotechnical measures be conducted to reduce the entry of strontium-90 from the soil to feed and food crops.

/Agrotechnical measures./ 1. //Removing the top layer of soil.// Radioactive substances are primarily contained in the top, 5-cm layer of the soil. This layer of the soil can be removed with a scraper, taken away and buried in a trench or dumped in a ravine or swamp. This measure can be conducted in small areas (truck gardens).

2. //Reducing the amount of strontium-90 in the root layer of the soil.// This is achieved by burying the upper, contaminated layer of the soil at a depth of 50-70 cm by plowing it deeply and turning the furrow over or by cutting the upper layer of the soil to a depth of 5-10 cm and placing it on the bottom of the furrow. After this procedure is accomplished, the strontium-90 content in plants is reduced by a factor of 8-10. Where the soil layer is not deep, the soil is plowed to a depth of 25-30 cm; at the same time, the strontium-90 is distributed throughout the entire depth of the plowed layer of soil and its content in a unit volume of soil is reduced; it will enter plants in lesser quantities (Table 35).

Table 35. The Effect of the Depth of Soil Cultivation on the Entrance of Strontium-90 into Agricultural Crops (in the year plowed)

| (1) Культура | (6) Вспашка на глубину до 25 см | | (9) Вспашка на глубину до 50 см | |
|---|---|---|---|---|
| | (7) урожай (ц/га) | (8) микрокюри в 1 кг | (7) урожай (ц/га) | (8) микрокюри в 1 кг |
| (2) Ячмень | | | | |
| (a) зерно | 40,0 | 0,8 | 40,0 | 0,4 |
| (b) солома | 60,0 | 9,6 | 60,0 | 5,5 |
| (3) Картофель, клубни | 620,0 | 0,9 | 750,0 | Следы (10) |
| (4) Кукуруза, зеленая масса | 520,0 | 7,3 | 500,0 | 1,9 |
| (5) Клевер, сено | 50,0 | 31,1 | 60,0 | 17,5 |

Key:

1. Crop
2. Barley
   a. Grain
   b. Chaff
3. Potatoes, tubers
4. Corn, green body
5. Clover, hay
6. Plowing to a depth of about 25 cm
7. Yield (centners/hectare)
8. Microcuries in 1 kg
9. Plowing to a depth of about 50 cm
10. Traces

3. /Destroying the sod./ Strontium-90 is preserved for many years in the sod of natural hayfields and pastures and it actually does not penetrate to a depth greater than 5 cm. At the same time, the isotope in the sod is primarily in the form of organic compounds and it is not absorbed by the minerals in the soil and, therefore, it is more accessible to the root system of plants. As a result of this, approximately 4 times as much strontium-90 enters meadow and pasture plants from the sod near the roots than is the case when hay grasses are grown on plowed land. Destroying the sod in meadows and pastures will significantly reduce the isotope's content in the underground parts of plants.

4. //Reducing radioactive contamination when harvesting corps // by precluding operations which are accompanied by the intensive formation of dust. When putting up hay, it is necessary to reduce the number of dusty operations (raking, etc.). It is recommended that crops with ears be harvested directly by combines. Mechanical methods of destroying weeds should be replaced with chemical methods.

/Agrochemical measures./ 1. //Putting lime on acid soils, soils with poor calcium transfer and also on soils which contain a large amount of active aluminum.// When 1.5-2 doses of lime are put on an acidic, soddy podzolic soil for the hydrolitic acidity, the strontium-90 content in plants is reduced by a factor of 2-5 and the cesium-137 content is reduced by a factor or 2-2.5. It is recommended that 6 tons of lime per hectare be put on sandy, podzolic sod and 10 tons per hectare be put on average and heavy loam. When the lime is introduced, not only does the content of radioisotopes decrease but the yield of agricultural crops also increases by a factor of 1.5-2. However, putting lime on the soil is only possible within the limits of the soil's capacity to absorb calcium. With a maximum exchange of calcium in the soil, putting down lime will not have a noticeable effect. It should also be borne in mind that putting lime on soils is not always desirable when growing potatoes and flax since these crops provide the best yield in acidic soils.

In magnesium-poor soils, dolomite meal has the best effect in reducing strontium-90 in the harvest.

2. //The introduction of organic fertilizers // (mulch, peat, pond sludge, manure) lowers the strontium-90 content in the harvest of agricultural crops most intensively when sandy soils are under cultivation and least when average and heavy loam soils are under cultivation. It is recommended that 20-30 tons of organic fertilizers per hectare be put on soddy podzolic soils

for grain crops and 30-80 tons be put down for cultivated crops. In this case, the strontium-90 content is reduced by a factor of 2-3.

The most effective action for reducing strontium-90, cesium-137, serium-144 and ruthenium-106 in the harvest is putting organic fertilizers and lime on the soil together (the strontium-90 content in the harvest is reduced by a factor of 4-6). Carting manure containing a large amount of strontium-90 to the fields is not recommended.

3. //Using mineral fertilizers.// Putting phosphorous fertilizers on soils of a certain type promotes the retention of strontium-90 in the soil (as a result of its settling with the phosphates). Specifically, the employment of fertilizers is effective in the land of western Siberia, especially for winter crops. Nitrogen fertilizers should be used in doses which ensure a high increase in the harvest for the given soil and climatic conditions. Large doses of nitrogen increase the transfer of strontium-90 and cesium-137 from the soil to plants. Potassium fertilizers reduce the accumulation of cesium-137 in the harvest. The use of calcium fertilizers is effective for soils of several types. Monocalcium and monopotassium phosphates provide the best results.

The joint application of lime, organic and mineral fertilizers on light sandy and loam soils can provide a factor of 10 reduction of strontium in the harvest.

4. //Selecting crops and types of plants// with the most pronounced ability to discriminate strontium-90 or crops intended for commercial processing. It has been established that different kinds of the same crop do not accumulate the same amount of strontium-90 (Table 36).

5. //High soil fertility and agricultural cultivation,// improving the microstructure of the soil, using stimulators for plant growth, using high yield grades and an additional application of fertilizer, controlling weeds, etc. always promotes an increase in the yield of agricultural crops and, thereby, promotes a reduction in the content of radioactive isotopes in the harvest. //Irrigation// is one of the basic methods for increasing the yield of agricultural crops in zones with insufficient moisture. Using irrigation which ensures normal conditions for feeding plants and the greatest growth of the biomass promotes a reduction of the strontium-90 concentration in a unit mass of the harvest by a factor of 1.5-2. Excessive watering increases the amount of strontium-90 accessible to plants in the soil suspension; this leads to an increase in the transfer of this isotope from the soil to the plant. When there

Table 36. Accumulation of strontium-90 (nanocuries/kg) When the Soil Contains 1 Curie/Square Kilometer of it and 1 Mg-equivalent of Converted Calcium per 100 g of Soil

| (1) Культура и сорт | (2) Зерно | (3) Солома | (4) Листья | (5) Стебли |
|---|---|---|---|---|
| (6) Горох: | | | | |
| (a) Капитал | 8,4 | 413 | 642 | 327 |
| (b) Немчиновский | 5,4 | 253 | 242 | 254 |
| (7) Бобы: | | | | |
| (a) Русские | 11,2 | — | 481 | 388 |
| (b) Кормовые | 4,9 | — | 527 | 308 |
| (8) Подсолнечник: | | | | |
| (a) Саратовский | 4,7 | — | 430 | 143 |
| (b) Кормовой | 3,5 | — | 441 | 184 |

Key:

1. Crop and type
2. Grain
3. Chaff
4. Leaves
5. Stalks
6. Peas
   a. Capital
   b. Nemchinovskiy
7. Beans
   a. Russian
   b. Feed
8. Sunflowers
   a. Saratov
   b. Feed

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is insufficient moisture in the soil, the content of waste elements in plants, including strontium-90, increases.

6. //Localizing the plant root system in the upper layer of the soil.// It is beneficial to use this measure after the soil is deeply plowed by turning the furrow over. Localizing the root system in the upper layer of the soil is achieved by applying fertilizer to it with subsequent discing or shallow plowing and also by selecting crops with a fibrous root system.

7. //Putting agricultural crops in the appropriate soils.// It is more advisable to cultivate crops which assimilate more strontium-90 (clover, peas, vetch, buckwheat, etc.) in soils with a hard texture; in this case, less of the isotope is transferred to the underground part of the plants named than from light, sandy soils. It is more advisable to allocate softer soils for crops which assimilate less of the strontium-90 (oats, wheat, flax, cereal grasses). Thus, 7-8 times more strontium-90 accumulates in the chaff of oats cultivated in

sandy soil and 4-5 times more accumulates in the grain than when this crop is grown in blackearth containing the same amount of the isotope.

8. //Sowing early ripening grades// promotes less of an accumulation of the radioisotopes in the harvest due to the shorter length of their growth cycle in the contaminated soils.

## Feed Production on Land with an Increased Level of Radioactivity

During the period of intensive radioactive fallout from the atmosphere, the surface contamination of plants by radioactive substances will be predominant (more than 90 percent) over the root contamination. During the first days and months, isotopes with a short life make up a significant share of the activity in the products of a nuclear explosion; of these isotopes, the iodine isotopes represent the greatest biological danger (the period of "iodine" danger). Strontium-89 will be predominant in the radioactive fallout 2-3 months later and until the end of the year; in subsequent years, strontium-90 and cesium-137 will be predominant (the period of "strontium and cesium" danger).

It is practically impossible to change the levels of contamination of feed crops during the first years. Therefore, when proucing feed, preference should be given to root crops which are protected from radioactive dust by the ground; cereal crops to the leaves of which less radioactive dust adheres; grain crops with protected grain (leguminous, corn); and early ripening feed crops.

When putting up hay, secondary radioactive contamination of it by the soil should be avoided. Hay obtained from natural, poorly productive lands will be contaminated by radioactive substances to a greater degree than will hay from high yield, sown grasses. The outer leaves should be removed from feed cabbage.

Feed prepared at the farm must be stored immediately and protected against additional contamination by radioactive fallout.

It is recommended that feed contaminated by radioactive substances not be used immediately but after holding it for 2-3 months; during this time, their level of radioactivty will decrease significantly as a result of natural decay. Feed which is heavily contaminated by radioactive dust undergoes decontamination.

As the radioactive fallout decreases, the air route of plant contamination will decrease and the soil route will increase due to the accumulation of radioactive isotopes in the soil. Therefore, when producing feed, measures are taken for 5-7 years after nuclear explosions to reduce the strontium-90 and cesium-137 content in feed. Due to the firmer immobilization of cesium-137 in the soil in comparison with strontium-90, feed crops can be put in arable land with levels of cesium-137 contamination which exceed their levels of contamination by strontium-90 by a factor of 4-6. Feed production for milk livestock is organized on the cleanest land (not more than 2 curies of strontium-90 per square kilometer). Feed crops for animals intended for meat can be grown on land with a level of strontium-90 contamination up to 10 curies/square kilometer; grain for hogs and poultry can be grown when the soil is contaminated up to 50 and in exceptional cases up to 100 curies/square kilometer.

For a period of many decades, feed production must be carried out on aerable land; in this case, the strontium-90 content of feed crops will be significantly lower than for feed from natural areas. Natural accumulations and haymaking must be reduced to the minimum since more strontium-90 enters the bodies of animals with feed from such areas than with feed from field crop rotations. It is necessary to cultivate more potatoes and beets for feed.

The possible size of the accumulation of strontium-90 in various feed groups is shown in Table 37.

In all cases, it is necessary to monitor the content of radioactive substances in feed crops.

### Feeding Agricultural Animals in Zones with an Increased Level of Radioactivity

The level of contamination of livestock produce by radioactive substances depends upon the content of them in the feed, the amount of the feed in the ration and the method of keeping animals. All other conditions being equal, the greatest concentration of radioactive isotopes in milk and meat will exist when animals obtain their feed from natural areas. Therefore, on land with an increased content of radioactive substances, it is more advisable to change to keeping animals in stalls and obtaining the feed from field crop rotations. In this case, it is easier to control the content of radioactive substances in the rations for animals, and, consequently, it is easier to control the amount of them in livestock produce.

Table 37. Relative Strontium-90 Content in the Harvest of Feed Crops (calculated per unit of feed) Grown Under Similar Soil Conditions and with a Similar Content of the Isotope in the Soil. The Strontium-90 Content in 1 kg of Oats is Adopted as a Unit.

| (1) Культура | (2) Зерно | (3) Солома | (4) Корнеклубнеплоды | (5) Ботва |
|---|---|---|---|---|
| (6) Овес | 1,0 | 30 | — | — |
| (7) Ячмень | 0,8 | 30 | — | — |
| (8) Кукуруза восковой спелости | 0,3 | 45 | — | — |
| (9) Вика | 2,0 | 100 | — | — |
| (10) Горох | 1,0 | 100 | — | — |
| (11) Картофель | — | — | 1,4 | 200 |
| (12) Свекла сахарная | — | — | 8,5 | 100 |
| (13) Свекла кормовая | — | — | 8,5 | 200 |
| (14) Брюква | — | — | 15,0 | 600 |
| (15) Турнепс | — | — | 30,0 | 600 |

Note: The root crops and tops of root-bearing plants are converted to dry material.

Key:

1. Crop
2. Grain
3. Chaff
4. Root crops
5. Tops of root bearing plants
6. Oats
7. Barley
8. Corn, golden ripe
9. Vetch
10. Peas
11. Potatoes
12. Beets, sugar
13. Beets, feed
14. Turnips [napus]
15. Turnips [campestris]

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During the first period of a nuclear war, livestock grazing is stopped. Animals, especially milkcows, goats and sheep, should be fed "clean" feed from protected stockpiles. Otherwise, in addition to the strontium, cesium and barium isotopes, a significant amount of radioactive iodine isotopes can enter the milk; this presents a great danger for people.

When radioactive fallout settles in the winter, badly contaminated pastures and grass from natural areas should also not be used in the early spring. During this period, it is better to give the animals feed from field crop rotations or from the stockpiles on-hand; moreover, it is necessary to take into account the amount of radioactive substances entering their bodies in all cases.

In the next season, strontium-90 will be the most dangerous radioactive isotope; it enters all feed crops from the soil (structural contamination). Under these conditions, the feed with the lowest strontium-90 content is fed to milkcows and pregnant animals. With a daily milk yield of 10-20 kg, 0.13

percent of the strontium-90 which enters the animal's body with the feed during a day enters each liter of cow's milk and, with a yield of 5-10 kg, 0.17 percent of it enters the milk. It is more advisable to feed milkcows and pregnant animals grain, coarse feed from cereal crops, potatoes and corn. Due to the increased strontium-90 content, it is not advisable to include bran, turnips [napus], turnips [campestris] and the tops of root bearing plants in the rations for milkcows. They can be given to draft animals and to hogs and sheep which are being fattened (not during the lactating period). Due to the exclusion of leguminous crops from the rations for lactating and pregnant cows, a protein and calcium shortage may form. Calcium is usually replaced by introducing mineral additives to the ration (meat-bonemeal, bonemeal, tricalciumphosphate and others); moreover, this also reduces the absorption of strontium-90. The shortage of feed albumin is replaced by urea nitrate (not more than 100 g of urea per day) which is included along with feed rich in carbohydrates. Grain concentrates can make up 60 percent of the rations for fattening animals. It is advisable to give hydroponic greens to lactating, pregnant animals, young animals and also to poultry in the winter to replace the vitamin deficiency.

Cattle and hogs being fattened and also draft animals can be given feed with a higher strontium-90 content but clean feed should be given to the animals for 2-4 weeks and more before slaughter (Table 38). During this period, the easily exchanged strontium-90 will escape from the body and the content of it in the muscle tissue will be sharply reduced.

Rations with a reduced protein content facilitate a reduction in strontium-90 deposits in the skeleton and iodine-131 deposits in the thyroid gland. Introducing large amounts of feed crops from the Cruciferae family (cabbage, turnips and others which are rich in thiocyanates) to the rations reduces the escape of iodine-131 with the milk.

More strontium-90 enters the bodies of young, growing animals from the feed than enters the bodies of adult animals. Therefore, when young animals are being fattened, it is necessary to use feed with a lower strontium-90 content. It should also be borne in mind that, when the rations are saturated with vitamin $D_2$, strontium-90 deposits in the skeleton increase and, when there is an increased calcium content in the rations, they decrease. Thus, when the concentration of calcium in the rations for cows is increased from 50-70 to 220-240 g, the strontium-90 in the milk is reduced by 30 percent. Taking this into account, an increased amount of calcium should be put in the rations for milkcows.

Table 38. Using Milk and Meat During the Protracted Entry of Strontium-90 into the Bodies of Cows with the Feed.

| (1) Количество стронция-90 в суточном рационе (микрокюри на корову) | (2) Дойные коровы | | (5) При откорме на мясо | |
|---|---|---|---|---|
| | (3) будет содержаться стронция-90 в молоке при суточном удое 7—10 кг (микрокюри на 1 л) | (4) использование молока | (6) перед убоем на мясо содержать на чистых кормах (дней) | (7) использование мяса |
| 0,2 | 0,0006 | (8) Без ограничений | — | (8) Без ограничений |
| 0,5 | 0,0015 | (9) Переработка на сметану, творог, масло* | — | (10) То же |
| 1 | 0,003 | (10) То же | 5 | » » |
| 5 | 0,015 | » » | 10 | » » |
| 10 | 0,03 | (11) Переработка на масло | 10 | » » |
| 20 | 0,06 | (10) То же | 15 | Обвалка туш** (13) |
| 200 | 0,6 | (12) Переработка на топленое масло | 25 | (10) То же |

* Skim milk, whey and buttermilk are fed to young animals, hogs and wild animals

** The muscles are trimmed and used as food and the bones are destroyed.

Key:
1. Amount of strontium-90 in the daily ration (microcuries per cow)
2. Milk cows
3. Amount of strontium-90 contained in the milk with a daily milk yield of 7-10 kg (microcuries per 1.)
4. Milk use
5. When fattened for meat
6. Before slaughtering for meat, keep on clean feed (days)
7. Meat use
8. No restrictions
9. Processed for sour cream, curds, butter*
10. Ditto
11. Processed for butter
12. Processed for melted butter
13. Trimming carcasses**

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When there is a protracted entry of strontium-90 into the bodies of hens, 40 to 60 percent of the radioactive isotope from the daily rations will enter each egg; moreover, 96.5 percent of it will enter the shell and 3.5 percent of it will enter the egg white and yolk. Therefore, the strontium-90 content should be limited in the rations for laying hens.

7. Using and Growing Timber in an Area with an Increased Level of Radioactivity

During the period of intensive fallout from nuclear explosions (local and tropospheric) and depending on the conditions of the radiation situation, work directed at reducing the damage caused to a tree farm by radioactive substances is conducted. The radioactive dust falling on a large forest is primarily stopped by the tops of the trees (40-90 percent) while falling on the leaves, needles, branches and trunks of trees. A small part of the radioactive substances penetrates the canopy of the woods, settling on the grassy surface and the surface of the woods' covering. After the radioactive fallout, it begins to migrate vertically and horizontally: atmospheric fallout is blown by the wind (physical migration) or scattered when the leaves, needles, branches and bark fall off (biological migration). The radioactive nuclides partially penetrate the internal tissues of woody plants from the underground parts. Subsequently, the radioactive nuclides also enter the underground part of trees from the soil through the root system.

When the woods is contaminated by early products of a nuclear explosion, its contamination is primarily caused by the effect of beta-radiation which is actually completely absorbed by the tree tops. In comparison with the beta-radiation, the gamma rays are absorbed 10 times less.

Depending on the size of the doses absorbed by the trees, which determines the density of the contamination of the woods by radioactive substances, the contamination of the woods can appear as a temporary suppression of growth, a partial atrophy of branches or the complete death of trees and plantings. When a lethal dose of radioactive substances is absorbed at high levels of contamination, the complete death of the growth and plantings usually takes place during the first year. At a lower level of contamination, the depressed state of the trees is replaced by a period of slow restoration 2-3 years later (up to 10 years and more).

When there is radioactive fallout during the summer in //zone A,// a drying out of the coniferous trees and retarded growth for the deciduous trees can be expected over approximately 1/10 of the area (which absorbs a dose of gamma radiation of 40-400 rads through the tree tops); in //zone B,// the coniferous trees will die in half of the area and a strong contamination of them will be observed in the remaining part; in decid ous woods, a partial drying out of the trees is possible in half the area (where the tree tops absorb a dose of gamma radiation of 400-1,200 rads); in

//zone C,// the coniferous trees die completely throughout the entire area and a drying out of the trees is possible in deciduous woods.

With the partial or complete death of the trees, mass reproduction of entomological pests is possible and the fire safety situation sharply worsens. Therefore, measures directed at reducing the danger of fire, limiting the reproduction of entomological pests, using wood pulp economically and assisting in restoring the woods are taken.

/Cutting woods./ With radiation contamination of the woods, all the coniferous trees which have damage to over 85 percent of the tree tops and all the deciduous trees with over 95 percent damage to the tree tops are cut down. Woods of fir trees are cut down completely if over 50 percent of the mature trees, over 60 percent of the maturing trees and over 75 percent of the young trees have died. This is due to the fact that the remaining part of the trees will be blown down by the wind if only the dead trees are cut down.

It is more advisable to cut the woods in the winter time. In this case, the radiation dose for people is reduced, dust is not formed, the covering of the woods is not destroyed and the scale of soil erosion is reduced. The wood pulp is stripped at the cutting site. The remains of trees which are of no economic value are dumped in ravines and hollows.

With lower levels of radioactive contamination, only sanitary cuttings are conducted in mature groves, passages are cut in maturing groves and the trees which have over 85 percent of their tops dead are thinned out and removed in young groves.

/Planting woods/ on contaminated territory is conducted after the soil is plowed deeply by turning over the furrow. If the groves were not completely cut down, then the covering and the contaminated layer of the soil are removed in the areas where trees are being planted. At the same time, seeds or young shoots obtained from clean or lightly contaminated areas of woods are used. Heavy-duty tree planting materials are used for planting in badly contaminated areas.

/Using woods on land with an increased strontium-90 content./ It is more advisable to use land which is badly contaminated by radioactive isotopes with a long life, and which is for this reason excluded from agricultural rotation, for planting woods. About 50-60 years will pass until the woods are cut. During this time, a significant part of the radioactive isotopes will decay. It has been experimentally established that soil contaminated by strontium-90 up to 50 curies/square kilometer does not even affect the germination capability of the seeds of coniferous trees in the ground (pine, spruce, larch). But, the death of growing seedlings is observed under these conditions. Therefore, heavy-duty materials obtained from soils with less of the isotope are used to plant woods in soils with a high strontium-90 content. It is also taken into consideration that trees of deciduous species, for example, birch trees, assimilate a significantly greater amount of strontium-90 from the soil than coniferous trees (pines) do since they assimilate more calcium from the soil than the coniferous trees do; moreover, the deciduous species have more roots in the surface layer of the soil. In principle, woods can be planted in areas where the level of strontium-90 and cesium-137 soil contamination will not kill the young trees.

When woods are being grown on land with an increased content of radioactive isotopes with a long life, the wood pulp and bark will contain radioactive substances; moreover, there will be 10 times more of them in the bark than in the wood pulp (Table 39).

Table 39. Possible Radioactive Isotope Content in Coniferous Trees and Mushrooms at the Outer Borders of the Zones of Radioactive Contaminated Terrain Five Years After a Nuclear Surface Burst Conducted in the Summer (estimated values)

| (1) Зона | (4) Содержание изотопов на внешних границах зон в пикокюри/кг воздушно-сухого вещества | | | | |
|---|---|---|---|---|---|
| | (5) Древесина | | (6) Кора | | (7) Грибы |
| | $Sr^{90}$ | $Cs^{137}$ | $Sr^{90}$ | $Cs^{137}$ | $Sr^{90}$ |
| А | 12 | 2 | 120 | 280 | 30 |
| (2) Б | 180 | 30 | 1800 | 4 200 | 450 |
| (3) В | 600 | 100 | 6000 | 14 000 | 1600 |

Note: The strontium-90 content is two times greater in the wood pulp of deciduous species.

Key:
1. Zone
2. B
3. C
4. Isotope content at the outer borders of the zones in picocuries/kg of an air dried material
5. Wood pulp
6. Bark
7. Mushrooms

With levels of strontium-90 contamination exceeding 1 curie/square kilometer, gathering mushrooms and berries in the woods is prohibited. With strontium-90 contamination greater than 10 curies/square kilometer, branches, bark and wood pulp without bark cannot be used for fuel. With a maximum level of contamination of 10 curies/square kilometer, the wood pulp of the trunk, with the bark, is suitable for any economic purpose. With a maximum strontium-90 contamination of 50 curies/square kilometer, the wood pulp and bark of deciduous species can be used to make plywood, furniture and to build residential facilities. With a greater density of strontium-90 contamination, deciduous wood pulp is used to make cross ties, telephone poles and to build residential facilities. It is permitted to use coniferous wood pulp to make plywood, furniture and to build residental houses when the levels of strontium-90 contamination are greater than 50 curies/square kilometer, but, in this case, the outer age rings which are formed after the radioactive contamination are removed.

8. Protecting and Decontaminating Food, Feed, Water and Sources of Water

To avoid contamination of grain and other produce with NBC agents and substances, it is necessary to seal them off from the outer, contaminated air. For this purpose, storage facilities are sealed and insulated packaging and wrapping materials are used.

/Protecting food and grain in warehouses and storehouses./ When sealing warehouses, graneries and vegetable storehouses, all the holes in the doors, windows and enclosing structures (especially in the floors and the places where the walls join the roof) are covered and part of the windows are sealed up tightly with brick; broken windows are repaired and all the holes in windows are covered with putty, clay, etc.; shutters are made to cover the remaining window openings; doors are repaired and covered with an impenetrable material; rubber or felt strips are put in the jamb; holes in the roof (ceiling) and walls are covered (boards, Ruberoid, etc. are nailed up). All pipes and air ducts are equipped with gate valves.

Silage located in silos and haylage located in silos and trenches are reliably protected against NBC agents and substances; it is only necessary to seal the loading docks. Meat, fats and milk products are reliably protected in refrigerators.

/Protecting feed and produce under field conditions./ It is organized by simple methods with the materials on-hand at the farm. It should be taken into account that flax and cotton sacks do not protect the grain, flour and other produce located in them from NBC contamination.

Bundles of grain are covered with synthetic film, tarpaulin or a layer of straw, hay or sod. When covering them with tarpaulin, a layer of straw is put under it since binary gases and aerosol viruses can penetrate it (without an additional layer of straw, they can reach the grain and contaminate it). Piles of potatoes and root crops are covered like the grain, but it is best to lay a 20-30-cm layer of straw first and then cover it with a layer of dirt. Ventilation ducts are placed in several spots inside the pile along the length of it and drainage ditches are dug along the perimeter. Potatoes and root crops can be reliably protected in holes.

Stacks (ricks) of hay and straw are covered with tarpaulin, film or non-feed straw (Figure 66) [figure not reproduced]. When covering them with film or tarpaulin, their edges are tightly pressed to the ground with logs, stones or dirt. A 3-m wide strip is plowed along the outside of the rick or stack. In the winter, a layer of ice can be frozen on the haystacks.

The feed located on the territory of the livestock farm or near it, which is intended for use in the near future, is covered first. The stockpile of covered feed for milkcows must be estimated for at least 3 months.

/Protecting produce and forage in transit./ Produce is transported in special containers: flour carts, covered wagons, water tanks, refrigerator trucks, refrigerator cars and isothermal containers which ensure a reliable degree of tightness. Various sealed containers can also be used to transport grain forage. When being transported in a stake-body vehicle or cart, food and grain forage are covered with tarpaulin or synthetic film. Thick boxes with sealed tops covered by tin plate on the outside and also reliably sealed cardboard boxes and kraft sacks can be used to transport produce and grain forage.

/Protecting food and water under household conditions./ For this purpose, they are covered with materials at hand or packed in protective packages. Basements and cellars are sealed by the conventional method; the potatoes, carrots, beets, etc. stored in them are covered with film or repacked in multilayer, kraft paper sacks and tied up. Produce can be put in barrels or thick boxes; they are covered with film or oilcloth and thick paper and tied up.

All dry produce (sugar, pearl barley, flour, etc.) and also bread and dry bread can be reliably protected in packages of thick paper or small sacks of film. They are tied up tightly and placed in a kettle, bucket, cardboard box or plywood box; then, the lid is put on and they are tied up with film or oilcloth (Figure 67) [figure not reproduced]. Butter, margarine and solid fats are usually repacked in glass jars and covered with cellophane, film, parchment or normal paper on the outside and tied up. It is necessary to store the tied up, packaged produce in cupboards, refrigerators, storerooms, basements or cellars.

Stockpiles of water and liquid fats are usually stored in covered bottles, decanters, thermos bottles, food canisters and milk containers. Large stockpiles of water are stored in barrels and other containers.

Barrels of pickled food are covered with film or oil cloth on the outside and tightly tied up. All produce in sealed glass jars and tin cans (canned food, fruit, condensed milk, etc.) are reliably protected against NBC agents and substances.

Each family must keep a 2-3-day supply of produce (calculated for all members of the family)--canned meat and fish products, condensed milk, sugar, hardtack or dried bread--and also a 2-3-day supply of water (fruit juice, beverages).

/Protecting sources of water against NBC agents and substances./ Large, open sources of water (lakes, ponds, rivers) cannot be protected against contamination and such work is not planned. The water from artesian wells always flows fresh. It is sufficient to simply seal the water tower. The top of shaft wells are protected. A 30-cm thick layer of clay is placed around the wooden frame at a distance of 1 m and it is tramped down (the clay hinders the flow and seepage of rainwater into the well through the holes of the wooden frame). The clay is covered with a 15-cm layer of sand which is replaced with clean sand as it becomes contaminated. The top of the well is covered with a thick cover and a common bucket is suspended in it. A box made of boards or netting smeared with clay is built over the well. Trenches are dug along the periphery to drain rainwater. The clay catcher is not made around shaft wells equipped with cement collars.

## Decontaminating Food, Feed and Water Under Kolkhoz and Sovkhoz Conditions

The livestock protection team and the plant protection team conduct decontamination of feed and water on farms. The decontamination teams (groups) decontaminate the food and potable water at the kolkhoz (sovkhoz). The completeness of the decontamination measures is monitored by specialists of veterinary and medical facilities.

/Removing radioactive substances (decontamination)./ It is advisable to store all types of feed contaminated by radioactive dust higher than the permissible levels until their level of radioactivity drops to the permissible level. They are decontaminated when there is no stockpile of clean feed. For this purpose, the upper 20-cm layer of hay in the stacks is removed and a layer of the same thickness is cut away from the sides and put into storage; during the time of its storage, the level of radioactivity will decrease as a result of the decay of radioactive substances. Grain is also handled in the same manner. Radiation measurements are taken of the remaining hay or grain and they are fed to livestock when the level of their activity is within the limits of the permissible levels. Radioactive substances can be washed off of grain forage with water. Root crops are thoroughly washed with water many times or the top layer of them is scraped off.

Water is decontaminated by filtration distillation or letting it stand. When water is passed through a layer of sawdust, peat or carbon, the radioactive dust and part of the radioisotopes dissolved in the water are retained; sand only retains the radioactive dust. Decontamination with ion exchanging resin (positive and anion exchange resins) is the most effective. Water is effectively decontaminated by letting it stand when coagulants (clay and others) are added to it.

Food in burlap bags is cleaned with vacuum cleaners or repacked in clean bags. The surface, contaminated layer is cut away from solid fats. Slabs of meat are washed down with water. When there is structural contamination, meat is put into storage or reprocessed as sausage and canned goods which are stored; the radioactive substances will decay during storage.

When milk is contaminated by radioactive substances above the permissible limits, it is reprocessed into butter, condensed milk, dry milk or curds which can be stored for a longer period of time; the radioactive substances will decay during storage. An average of 2 percent of the early products of a nuclear explosion (percentage of the content of radioactive substances in a unit volume of milk) enters butter and an average of 20-40 percent enters curds. Table 40 shows the magnitude of the transfer of individual radioactive isotopes from milk to milk products.

When sugar beets are being processed, 0.02 percent of the strontium-90 can enter the sugar, 52.8 percent can enter the pulp and 0.8 percent of it can enter the syrup; when potatoes are being processed, 2 percent of the strontium-90 can enter the starch.

Table 40. Transfer (percent) of Radioactive Isotopes from Milk to Milk Products Made at a Plant

| (1) Вид продукта | (2) Стронций-90 | (3) Цезий-137 | (4) Йод-131 |
|---|---|---|---|
| (5) Молоко | 100 | 100 | 100 |
| (6) Сливки | 8 | 15 | 16 |
| (7) Обрат | 92 | 85 | 84 |
| (8) Масло сливочное | 1,28 | 2,25 | 3,52 |
| (9) Пахта | 6,72 | 12,75 | 12,48 |
| (10) Казеин сычужный | 84,60 | 1,84 | 1,84 |
| (11) Сыворотка сычужная | 7,40 | 83,16 | 82,16 |
| (12) Казеин кислый | 6,45 | 1,80 | 4,60 |
| (13) Сыворотка кислая | 85,55 | 83,20 | 79,40 |

Key: 1. Type of product
2. Strontium-90
3. Cesium-137
4. Iodine-131
5. Milk
6. Cream
7. Skim milk
8. Butter
9. Buttermilk
10. Rennic Casein
11. Rennic whey
12. Caseinic acid
13. Acidic whey

/Chemical agent decontamination./ Under kolkhoz and sovkhoz conditions, food and forage are decontaminated by airing, heat treatment and chemcial methods. The upper, contaminated layer is removed from haystacks, vegetable piles and bundles of grain; the feed is spread out in a thin layer on uncontaminated ground and aired out while periodically turning it over. During the warm season, forage can decontaminate itself: in 2-4 days when contaminated by sarin, in 5-10 days when contaminated by mustard gas and in 20-45 days when contaminated by somane. It takes bulky forage longer to decontaminate itself than it does grain forage. Hay and straw can be decontaminated by soaking them in a 10-12 percent solution of ammonia for 2 days or in a solution of construction lime (pH = 9). Root crops are decontaminated with preparations containing chlorine and subsequently washed thoroughly with water.

When forage and food located in buildings are contaminated by non-persistent chemical agents or by pairs of persistent agents, the doors, windows and ventilation devices are opened or the forage and food are taken outside and aired until the chemical agents disappear from them.

Mustard gas, sarin and binary gases are decontaminated from green forage very well in a grain dryer with a high-temperature heat transfer agent or by the chemical method and by treating it with decontaminating agents and subsequently washing it thoroughly.

Slabs of meat are decontaminated by airing and also by heat treatment (boiling thoroughly, treating with steam).

When small amounts of chemical agents have fallen on food, it is decontaminated by boiling. When food and forage are contaminated by lewesite, it is mandatory to study them for arsenic content after decontamination; depending upon the concentration of it, the issue of using the cited produce is also resolved.

The glass jars, bottles, and also, kettles, canisters, kraft bags, polyethelene packaging and various containers in which food is stored are decontaminated by washing (wiping) their surfaces with decontaminants.

Water is decontaminated (when there is no uncontaminated, pure water) by boiling and chlorination. Water is drawn from contaminated shaft wells and decontaminated; the frames are smeared with a bleaching powder paste and bleaching powder is sprinkled on the bottom. After this, the water accumulated in the well is drawn again and removed. The next portion of water is checked for its content of chemical agents and chlorine; when the amount of them is not dangerous to animals and people, it is permissible to use it. When the territory of artesian wells or covered springs are contaminated, the water towers, cappings, areas for drawing water and the surrounding territory are decontaminated.

/Disinfection./ Food, forage and water are disinfected by chemical and physical methods. Thus, the surface of a haystack contaminated by spores of Siberian ulcers is treated twice within a 24-hour period with a 4 percent solution of formaldehyde; for each treatment, a 2-liter solution is calculated for each square meter of the stack's surface. The solution is applied under a pressure of at least five atmospheres and it is sprayed in small particles. After this, the hay (straw) is aired.

Grain forage (oats, barley, corn) contaminated by spores of the agent for Siberian ulcers is destroyed. It can also be decontaminated by submerging it in a 4 percent solution of formaldehyde for 24 hours or in a 2 percent active solution of chloramine (in tight barrels with lids). After this, the grain is taken out of the barrels and dried until the odor completely disappears.

Nonsporous microorganisms in grain can be destroyed by treating it in a grain dryer operating in the high temperature mode. Grain forage contaminated by the agent of botulism or its toxin is decontaminated by soaking it in a one percent solution of sodium hydroxide for a period of four hours and by subsequently washing it out thoroughly three times in water and drying it out.

When there is a sufficient quantity of film at the farm, hay and grain forage can be decontaminated with a gaseous mixture--methyl bromide and ethylene oxide in a ratio of 2:1 (1.5 kg of the gas per cubic meter of air at a pressure of 300-mm of mercury)--in the summer at temperatures of +15 degrees C and greater. Water is decontaminated by boiling or chlorination.

Food contaminated by sporous types of microorganisms and toxins is destroyed; food contaminated by nonsporous forms of pathogenic microorganisms is decontaminated by boiling; fats are decontaminated by remelting them.

Meat contaminated by sporous types of microorganisms can be disinfected with steam in closed kettles under a pressure of 1.5 atmospheres (2.5 hours exposure) or it is processed as canned goods sterilized at 120 degrees. Meat contaminated by nonsporous types of microbes, viruses and Rikettsia is decontaminated by boiling.

//Safety measures during decontamination.// All work on decontaminating food, forage and water is conducted with a strict observation of safety measures and after the appropriate instruction. When working with objects contaminated by radioactive substances, it is important to not allow personnel to receive excess radiation. Work is conducted in individual protective gear. During the work, it is forbidden to take food or drink, smoke, sit down or lie down on contaminated objects and it is forbidden to remove the individual protective gear. After the work, the individual protective gear is decontaminated; the people who conducted the work on decontaminating objects go through personal cleansing.

9. Quick Methods for Detecting Radioactive Substances, Herbicides and Biological Agents in Food, Feed and Water

/Quick methods for detecting radioactive substances./ These methods are based on the relationship between the rate of gamma radiation from the object being studied and the radioactive substances contained in the volume of the object being studied. They are divided into field and laboratory methods. The field methods are used during the first 30 days after nuclear explosions and the laboratory methods are used during the period of a year.

1. //Detecting radioactive substances in small amounts with the DM-5A(B) [dosimeter].// The gamma background (level of radiation) is measured first in microroentgens per hour with the DM-5A(B) in the area where it is anticipated that radioactive produce, feed or water will be detected. In this case, the tip of the meter's probe must be one m above the ground and the screen of the meter's probe must be in the "G" position.

If the gamma background exceeds the permissible level of contamination for the given object by a factor of three and more, measurements cannot be taken since unreliable figures will be obtained for the true radioactive contamination of the object. In these cases, measurements are taken behind some sort of shield, in a mud hut, dugout or building which reduces the gamma radiation from the surrounding environment. After measuring the gamma gackground, the rate of the dose of gamma radiation is measured for an object being studied (produce, feed, water) which has a strictly defined capacity: a one 1 bucket, a 1.5 l kettle, a loaf of bread, etc. At the same time, the tip of the meter's probe with the screen in the "G" position is held at a distance of 1-1.5 cm from the surface of the object being studied. The gamma gackground is subtracted from the figure for the rate of the object's radiation dose and the value of the level of radioactivity obtained is compared with the permissible level confirmed for the given produce. The measurement error is plus or minus a factor of two-three.

2. //The quick method of detecting radioactive substances with the DM-5B(A) and the subsequent calculations according to a formula.// The gamma background is first measured with the DM-5B at a distance of at least 200 m from the object being studied. Then, the object (grass, grain, etc.) is approached and the rate of the dose is measured at a distance of 1 m from it. In both cases, the probe's screen must be in the "G" position. The calculation is conducted according to the formula $Q = P \cdot n$, where Q is the level of radioactivity of the object being studied in microcuries/kg (1); P is the rate of the dose of gamma radiation from the object of measurement without the background, in r/hr [roentgens/hour]; n is an experimentally established coefficient for each object (it is 100,000 for grass, 300 for milk, etc.).

> Example. In a field where the level of radiation equals 1 r/hr, a mixture of vetch and oats is cut and taken to the farm. The gamma background radiation on the farm's territory equals 0.4 r/hr and the rate of the dose from the mixture of vetch and oats equals 0.7 r/hr (together with the background). Putting this data in the formula, we get: $Q = (0.7 - 0.4) \cdot 100{,}000 =$ 30,000 microcuries/kg or 30 milicuries/kg. It is necessary to convert the value obtained for the daily ration and compare it with the permissible amount of radioactive substances in the daily ration for animals.

/Laboratory methods for detecting radioactive substances./
1. //The quick method for determining the proportional level of radioactivity* in a thick layer.// This method is used to measure preparations with a proportional level of activity within the limits from 0.1 to 100 microcuries/kg and up to a year while the products of a nuclear explosion are aging. For this purpose, a small aluminum or plastic (made from the film of a filmstrip) beaker 26-mm in diameter and 10-mm high (or 40-mm in diameter and 30-35-mm high) is taken and it is densely filled to the top (without weighing) with the produce being studied; meat, grass, coarse feed, macaroni etc. is ground up well. Then, the DM-100 conversion unit is prepared for operation (according to the technical description attached to it). The sample (preparation) in the small beaker is put in the lead booth of the GDD-17 [gas discharge dosimeter] so that its surface is located at a distance of 10 mm (or 20 mm) from the opening of the meter and readings are taken twice. The arithmetic average is calculated based on the results of the two measurements; the level of activity of the specimen under study is calculated according to the formula: $A=(N_{пр} - N_ф)\cdot K$, where A is the level of beta activity in microcuries/kg (1); $N_{пр}$ is the rate measured for the sample along with the background in pulses per minute (the average value); $N_ф$ is the rate measured for the background in pulses per minute: K is an experimentally established coefficient; for small beakers with a diameter of 26 mm and when the sample is placed at a distance of 10 mm from the meter's opening, it equals 0.015; for small beakers with a diameter of 40 mm and when the sample is placed at a distance of 20 mm from the meter's opening, it equals 0.027. The measurement error is ± 150-200 percent.

> Example: The rate calculated for a sample of grain forage (a small beaker with a diameter of 26 mm) located at a distance of 10 mm from the GDD-17 meter's opening equals 230 pulses/min. The background of the unit is 30 pulses/min. The level of activity is: A = (230 - 30) · 0.015 = 3 microcuries/kg. The value obtained is compared with the permissible level and the problem of the suitability of the grain forage for feeding animals is resolved; in this case, it is important for the radioactive content not to exceed the permissible value for the daily rations.

2. //The precise determination of the proportional level of radioactivity// in food, feed and water is conducted in laboratories according to special methods described in the radiological literature.

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*By proportional level of radioactivity, we mean the concentration of radioactive substances per unit of weight or volume (curies/kg; curies/l; microcuries/kg; etc.)

/Determining the level of radioactivity on surfaces./ The radioactive contamination of agricultural equipment and of the body surfaces of animals and men is determined in the following manner. First, the gamma background is determined for the area of the anticipated measurement at a height of 1 m from the surface of the ground. Then, in the same area, the level of radioactivity of the entire surface is measured in r/hr (mr/hr) with the probe of the DP-5A(B) and the screen in the "G" position at a distance of 1-1.5 cm from the object being studied (person, animal, vehicle). The following formula is used for the subsequent calculations: $P_{об} = P_{изм} - \left(\frac{P_ф}{K}\right)$, where $P_{об}$ is the level of radioactivity of the surface of the object under study; $P_{изм}$ is the level of radioactivity of the surface of the object together with the background as measured by the DM-5A(B) meter; $P_ф$ is the gamma background; K is a coefficient which takes the screening effect of the object into account. For motor vehicle and agricultural equipment, it equals 1.5; for the body surfaces of men and animals, it equals 1.2; and for individual protective gear, packages of food and food storerooms, it equals 1.0. The value obtained in this manner is compared with the permissible level.

> Example: The gamma background for the area of measurement equals 0.3 r/hr. After harvesting grain in radioactive contaminated terrain, the level of radioactivity of the combine equalled 0.6 r/hr. The true radioactive contamination of the combine is:
>
> $$P_{об} = 0{,}6 - \frac{0{,}3}{1{,}5} = 0{,}4\ р/ч.$$

Two measurements--one with the opening of the DM-5A(B) meter's probe closed and the second with it open--are taken to determine the radioactive contamination of surfaces through which gamma rays pass (the bodies of motor vehicles, thin wooden walls and the dividing walls of structures) and also to determine the presence of radioactive substances within the body of a man or animal. If the meter readings are the same with the probe's opening closed and open, the surface under study is not contaminated by radioactive substances. The gamma radiation is passing through the surface being studied from the other side of it (or from the internal tissues of the body). If the readings are greater when the opening of the meter's probe is open than when it is closed, the surface is contaminated by radioactive substances.

> Example: The dosimeter operator establishes the level of radioactivity for the surface of a cow's body. The gamma background in the area of measurement is 0.2 r/hr. The level of

radioactivity of the surface of the cow's body on the left and right equals 0.5 r/hr with the probe's opening closed and it is 0.8 r/hr with the probe's opening open. Consequently, the surface of the cow's body is contaminated by radioactive substances; the value for the contamination is:

$$P_{об} = 0,5 - \left(\frac{0,2}{1,2}\right) = 0,34\ р/ч.$$

This value is compared with the permissible level.

/Quick methods for detecting chemical warfare agents./ The detection of chemical agents in the air, food, feed and water with chemical reconnaissance devices is described in Chapter 3. Field methods for detecting herbicides are set forth here.

/Detecting herbicides./ 1. The fact that the enemy has employed herbicides and the approximate level of plant contamination can be detected by //a visual inspection// of the fields and according to the external signs of plant damage if the herbicides were used in casualty-producing doses (see Chapter 2).

2. //The fluorescent method.// This is the easiest method for detecting the 2,4-D spray, the amount of it and the time of its use. The second from the top, small leaves (standard in size) are taken from the cotton plants; they are put in a previously prepared 0.01 percent solution of alcohol and fluorescein (100 mg of the dye is dissolved in 5-10 ml of the rectified alcohol spirits and then the volume is brought up to 1 l) and they are kept in it for a period of 40 minutes. When this time has lapsed, the leaves are washed with water from a tap for 15-20 minutes (they can be washed in trays); after this, they are put between sheets of filter paper in a press for 2-3 hours. The cotton leaves dried in the press are suitable for subsequent analysis. They are spread out in Petrie dishes one at a time, put under the fluoroscope at a distance of 5-7 cm from the light filter in a slightly inclined positon and examined under ultraviolet light. To determine the level and time of contamination of the cotton, the nature and degree of brightness of the leaves being analyzed are compared with color standards prepared previously according to special instructions or a special lighting scale is used.

3. //The reaction of sodium dithionite* on paraquat.// Contaminated leaves are cut off with scissors put in a test tube, covered with

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* Sodium hydrosulfite

80 percent ethylalcohol and shaken for a period of 5 minutes; after this, the bath is carefully poured into a graduated test tube through a paper filter. An alcohol bath from a tray exposed in the field can be taken for the analysis. Two-three drops of the solution being studied are put on a strip of filter paper; they are kept in the air for 1-2 minutes and then the paper is slightly sprayed with a solution of water saturated with ammonium chloride and immediately afterwards with a 1 percent solution of sodium dithionite in twice the normal solution of sodium hydroxide. If paraquat is present, blue spots appear which disappear a minute later but appear again after the paper is sprayed again with sodium dithionite. The sensitivity is 0.1 mkg.

Other methods for detecting herbicides, including //laboratory// methods, are set forth in special manuals. For a laboratory analysis, 15-20 plants from each section of the field are sent to the laboratory or an alcohol bath from trays and other surfaces is sent.

/Quick methods for detecting biological agents./ Indicative, accelerated and conclusive methods of research are used to detect the agents of infectious diseases on objects in the external environment.

//Indicative (approximate) methods// make it possible to obtain an answer 1-2 hours after the beginning of the study. The luminescent-serological method and the microscopic dried smear technique belong to these methods.

//The luminescent-serological method// is based on the fact that, when microbes are treated with luminescent sera, they unite with the luminescent antibody and acquire the ability to shine (liminesce) under ultraviolet or blue light. At the same time, each type of microbe is distinguished by a specific light.

//The microscopic dried smear technique,// where dried smears are tinted with special dyes, is used for detecting, for example, the agent of Siberian ulcers.

//Accelerated research methods// are differentiated depending on the type of microorganism. Microorganisms are grown in an accelerated manner in special, nutritive environments using growth stimulators. The culture which is grown in this manner is then used to contaminate experimental animals which are susceptible to it or dried smears are prepared from it for the microscope. Various reactions (the reaction to the build up of titer and others) and tests (tests on sensitized porpoises) are resorted to.

//Conclusive methods.// The final result is obtained after a complete bacteriological study of contaminated experimental animals.

/Determining the level of spores in the air and on crops./ Microscope slides taken from wind vanes or the POZR-M [expansion unknown] meter are used for this purpose.

1. The microscope slides taken from weather vanes are first examined quickly under the microscope. In the event spores are detected, they are counted without exception along the three longitudinal strips (when there are a few spores--3-5 per visual field of the microscope) or they are counted in the 20 visual fields for each strip (60 visual fields; if more than 5 spores are detected per visual field of the microscope). The number of spores throughout the entire slide and for a square centimeter of it is then calculated according to the formulas:

$N = \frac{nb}{d}$ --for a compact examination of the longitudinal strips or

$N = \frac{1,27 n_1 b l}{d^2}$ --for an examination of the 60 visual fields,

where N is the number of spores on the entire slide (units); n is the average number of spores in an individual strip (units); $n_1$ is the average number of spores in a single visual field (units); l is the length of the part of the slide (mm) being examined; d is the diameter of the microscope's visual field (mm); b is the width of the slide (mm).

Examples: a) the average number of spores in one strip (n) is 100; the diameter of the visual field (d) is 1.66 mm (determined previously); the width of the slide (b) is 25 mm. The number of spores on the entire slide in the given case is: $N = \frac{100 \cdot 25}{1,66} = 1506;$

b) the average number of spores in one visual field ($n_1$) is 10; the length of the slide (l) is 70 mm, the width (b) is 25 mm; the diameter of the visual field is 1.6 mm. The number of spores on the entire slide is: $N = \frac{1,27 \cdot 10 \cdot 25 \cdot 70}{1,66} = 8052.$

To determine the number of spores in a square centimeter, the total number of them should be divided by the overall area of the slide (deducting for the extreme parts of it which were covered by the grooves of the wind vane and also for the edges covered by the specimen mount).

2. With the POZR-M meter, the level of spores on crops is determined according to a special method.

The results of the analyses of the level of spores in the air and on crops are written down on special reporting form No 1. The points of observation and form No 1 are sent to the plant protection station. When one or more uredospores are detected on a square centimeter of the slide from the wind vane, this information is immediately sent by telephone or telegraph to the chief of the rayon's plant and animal protective service and form No 1 is sent later.

With favorable weather conditions (relative humidity at crop level of at least 75 percent, the presence of dew and optimal air temperature) and during favorable stages of plant growth, a bad epiphytic condition can be expected to arise when 0.6 or more spores have fallen on a square centimeter of the slide's surface during a 24-hour period for a phytophthora infection of potatoes and when one spore or more have fallen on a square centimeter of the slide's surface during a 24-hour period for cereal stalk blight.



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