15 Annex - Energy

84. RULEBOOK ON INTERVENTIONAL AND DERIVED INTERVENTIONAL LEVELS AND MEASURES FOR PROTECTION OF THE POPULATION, LIVESTOCK AND AGRICULTURE (VETERINARY PRACTICE, PLANT PRODUCTION AND WATER MANAGEMENT) IN THE EVENT OF EMERGENCY

RULEBOOK

ON INTERVENTIONAL AND DERIVED INTERVENTIONAL LEVELS AND MEASURES FOR PROTECTION OF THE POPULATION, LIVESTOCK AND AGRICULTURE (VETERINARY PRACTICE, PLANT PRODUCTION AND WATER MANAGEMENT) IN THE EVENT OF EMERGENCY

(Official Gazette of the Federal Republic of Yugoslavia 18/92)

BASIC PROVISIONS

Article 1

This Rulebook shall prescribe interventional levels and derived interventional levels as well as measures for the protection of population, livestock and agriculture (veterinary practice, plant production and water management) in emergency situations intended to provide protection from ionising radiation.

Article 2

1. An emergency, in the context of this Rulebook, is a nuclear accident or radiation danger, uncontrolled event at a nuclear plant, research reactor or any other installation which cause or has caused contamination of the working environment, irradiation of workers at the installation or contamination of natural environment and population.

2. Interventional radiation levels are designated radiation doses in the event of a nuclear accident requiring consideration of protection measures to be undertaken due to its detrimental impact on human health.

3. Derived interventional radiation levels are expressed as the amount of radionuclides in the air, drinking water and food or the intensity of external gamma radiation which are derived from interventional levels of radiation doses.

Article 3

Given the applicable protection measures, a nuclear accident is divided into three phases:

1) early phase is divided into a period before the discharge of radionuclides, when the potential danger of irradiation has been established, and a period when the largest discharge of radionuclides occurs;

2) intermediate phase is the period proceeding from the early phase in which radionuclides accumulate as a component of ground deposition; based on measurements of external radiation dose and radionuclide activity in the air, drinking water and food, an assessment of population irradiation is made on the basis of which protection measures are taken;

3) late phase (recovery phase) begins with the return of population to normal living conditions.

The duration of the early phase ranges between half an hour and several days; the intermediate phase – from several hours after the beginning of the radionuclide discharge up to several days or weeks; and the late phase – from several weeks to several months or years, depending on the amount and composition of released radionuclides, the given season of the year and territory where the said protection measures were in force.

Article 4

In the vicinity of a nuclear accident there are two distinguishable areas:

1) the area around the site of the nuclear accident with several-dozen-kilometre radius where the principal types of population irradiation are as follows:

a) external exposure from radioactive plume (cloud),

b) inhalation of radioactive noble gases and aerosols, and

c) external exposure from ground deposition of radionuclides,

2) wider area which is several hundred kilometres away from the nuclear accident site where the principal type of population irradiation occurs through contaminated food and drinking water.

Article 5

In the early phase of a nuclear accident possible types of exposure to radiation are as follows:

1) direct exposure from radioactive plume,

2) inhalation of evaporable and aerosol particles,

3) absorption due to contamination of skin and clothes.

In the intermediate phase possible types of exposure to radiation are as follows:

1) absorption due to contamination of skin and clothes,

2) resuspended inhalation of particles,

3) exposure to radiation from radioactive materials deposited in the ground.

In the late phase of a nuclear accident possible type of exposure to radiation is the ingestion of contaminated food and drinking water.

Article 6

The planning of protection measures in the event of a nuclear accident is based on the following:

1) avoidance or maximum reduction of grave non-stochastic effects of the acute radiation disease (ARB) by way of planned and timely protection measures intended to reduce the individual absorption dose to the level below biologically relevant impact;

2) reduction of risk from stochastic effects by way of implementing measures which reduce the danger for every contaminated or irradiated individual;

3) reduction, to the degree which may be justified by practical reasons, of general recurrence of stochastic effects by way of decreasing effective dose equivalent.

II INTERVENTIONAL AND DERIVED INTERVENTIONAL LEVELS

Article 7

Derived interventional level for individual radionuclide and the manner in which a person is exposed to radiation are determined as follows:

$$DIL = \frac{IL}{DCF}$$

where:

DIL is the derived interventional level for individual radionuclide in a specific environment;

IL is the interventional level of radiation dose commitment for the exposed person in a specific environment (medium);

DCF is the dose conversion factor in units determined with respect to IL and DIL.

The methodology of the International Atomic Energy Agency No. 81 from 1986 is used to assess derived interventional levels.

The assessment of derived interventional levels is performed for every radionuclide and all types, i.e. radionuclide exposure pathway types.

In the early phase of a nuclear accident only the most important radionuclides are taken into account.

In the event of contamination of the food chain, one's own derived interventional levels may be determined by using the formula which ensures that the interventional dose level (5 mSv) has not been exceeded, i.e.

$$\frac{S\ S\ C(i,f)}{i\ f\ DIL(i,f)} \leq 1$$

C(i,f) is the absorbed radionuclide activity (i) in the group of food products (f), while

DIL (i,f) is the derived interventional level for radionuclide (i) in the group of food products (f).

Protection measures should be applied in the following conditions according to the formula:

$$\frac{S\ S\ L(i,p)}{p\ i\ DIL(i,f)} \geq B\ 1$$

L(i,p) is the measured radioactivity level for nuclides (i) in a specific medium related to the exposure pathway (p), while

DIL(i,p) is the derived interventional level for radionuclide (i) in the same medium and exposure pathway type (p) as determined in keeping with the proposed protection measures.

Article 8

Interventional levels of radiation doses in mSv are given for the entire body or individual organs in two levels which are mutually different by the factor of 10. The lower level of the dose is the level below which no protection measures are justified, while the upper level of the dose is the level above which protection measures almost certainly should be applied, which entails the assessment of benefits achieved by taking protection measures and expenses resulting from these measures.

Protection measures in different phases of a nuclear accident, depending on their presentation, are given in tables 1 and 2, which are published alongside with this Rulebook and constitute the integral thereof.

Interventional levels and an overview of protection measures depending on the nuclear accident phase are given in the following table:

1	2	3
		a) Early phase
Dose mSv		
whole body	lungs, thyroid gland or any other individual organ	Protection measures
5 to 50	50 to 500	removal
50 to 500	500 to 5000	50 to 500 use of stable iodine evacuation

	b) Intermediate phase	
Expected dose in the first year (mSv)		
5 to 50	50 to 500	supervision over food products and drinking water relocation
50 to 500	not expected	

With an accident where it is estimated that radiation might range between the lower and upper levels in the first week after the accident occurred, the protection measures are proposed in keeping with the interventional levels given in the following table:

Dose in mSv		
whole body	lungs, thyroid gland or any other individual organ	Protection measures
5 do 25	250	shelter
		use of iodine compounds
	250	
100	300	evacuation

Article 9

Derived interventional levels for individual radionuclides in food and water are given in the following table:

Food for children	Bq/kg
131I	500
90Sr	125
137Cs	1000
239Pu	20
Drinking water	
90Sr	160
239Pu	7

Food for adults	
131I	2000
90Sr	750
137Cs	1000-1250
239Pu	20
Drinking water	
90Sr	700*
239Pu	7

*reference to low dose radionuclides (10-8 Sv/Bq)

Dose factors for the most important radionuclides: 90Sr, 131I, 134Cs, 137Cs and 239Pu for small children (up to one year old), children below 10 yrs of age and adults are given in the following table:

Radionuclide	Dose factors Sv/Bq		
	infants (up to 1 year)	children (up to 10 yrs)	adults
90Sr,	1.1 x 10-7	40 x 10-8	3.6 x 10-8
131I (*),	3.6 x 10-6	1.0 x 10-6	4.4 x 10-7
134Cs,	1.2 x 10-8	1.2 x 10-8	2.0 x 10-8
137Cs,	1.0 x 10-8	1.0 x 10-8	1.3 x 10-8
239Pu,	2.4 x 10-6	1.4 x 10-6	1.3 x 10-6

(*) Applicable only to thyroid gland.

In order to implement derived interventional levels it is assumed that the annual average food consumption per capita is 550kg; drinking water – 700l per capita, where the figures for an infant are – 275 l of milk and 275 l of water.

To calculate the quantities from the previous paragraph statistical data on annual average consumption of staple food per capita in Yugoslavia are to be used.

Article 10

Within a nuclear facility four groups of workers are to be organised in order to help protect the population:

I group – workers who are to help reduce the detrimental impact of a nuclear accident which is beyond the control of the protection system and out of reach of the special teams trained for dealing with emergency situations;

II group – workers at the nuclear facility who carry out the tasks related to measures being implemented aimed at reducing the exposure to radiation and radionuclide emissions from the nuclear facility;

III group – workers outside the nuclear facility who are tasked with the implementation of protection measures; and

I*V group* – workers outside the nuclear facility who are tasked with rehabilitation of houses, buildings, facilities of vital importance for the provision of food and drinking water to the population, other facilities of importance, major traffic arteries, etc.

Interventional dose level for the protection from non-stochastic effects in case of the workers from the first group is 500 mSv for the entire body, or 5000 mSv for individual organs. The relevant data for workers from the second, third and fourth groups are given in the following table:

Worker group		Dose level which should not be exceeded mSv		
		during 1 year	immediately	lifetime
II	entire body	50	100	250
	individ. organ	500	1000	2500
III	entire body	50	100	250
	individ. organ	500	1000	2500
IV	entire body	50		
	individ. organ	500		

Radiation dose level is radiation exposure of an individual from external and internal radionuclides – internal contamination of human body or individual organs.

Corrections for establishing annual dose levels which must not be exceeded are performed on the basis of measurements of discrete intensities of ionising radiation from external sources and degrees of radiation from internal contaminations in the entire body or individual organs in the course of the year.

Accumulated doses of external and internal individual irradiation constitute the entire radiation dose stated in the table and expressed in Sv.

Workers from each group may be exposed to radiation, contamination without conspicuous physical wounds and with wounds (combined radiation injuries). The severity of the injury is established depending on the individual radiation dose, i.e. contamination of every examined individual and severity of the combined injury.

In the early phase of the nuclear accident, if irradiation has occurred, as first medical aid only symptomatic treatment (sedatives, analgetics, anti-vomiting drugs...) is applied.

III POPULATION PROTECTION MEASURES

1) Protection measures in the early phase of the nuclear accident

Article 11

In the early phase of the nuclear accident the following measures are to be undertaken:

1) providing timely and accurate information to the population as well as necessary instructions;

2) extended stay in apartments, flats and houses and setting up of a sanitary passageway;

3) utilisation of purpose-built shelters,

4) utilisation of stable iodine compounds (SPJ),

5) population evacuation,

6) control of access to the contaminated zone.

Article 12

The information intended for the population that may be exposed to radiation or contamination is passed on by means of designated audio signals, via radio and other mass media outlets. The information provided to the public must be clear and understandable to the population; it must be credible in the eyes of the members of the public; it must not cause panic, fear and other psychogenic reactions in sensitive individuals.

Article 13

In order to prevent internal contamination of individuals through respiratory organs the measure of an extended stay in apartments, flats and houses with sealed doors and windows and switched-off ventilating systems (which should be occasionally switched on) must be implemented. The ventilating system should not be switched off if it contains air filters which are to be changed more frequently. Protective masks, respirators or other makeshift devices (handkerchief, gauze or clean cloth) are to be placed on noses and mouths.

Sanitary passageways (in houses and buildings) are set up in entrance halls immediately behind the entrance doors. The floors are fitted with thick polyvinyl foil. Clothes and shoes are placed in anterooms after which home outfits and slippers are put on. Clothes and shoes which are worn outside should not be brought into flats and apartments. On entering the apartment, hands and exposed parts of the body must be washed with cold water.

Before the implementation of the measure of an extended stay in flats, apartments and houses, one should prepare adequate quantities of food and drinking water. In the implementation of this measure, small children and pregnant women should not leave flats and apartments and they should take food which has not been exposed to radiation. Mass sports events are not allowed. During breaks between classes in schools children should not be allowed to play in dusty segments of the playground. A proposal to suspend the work of pre-school and school institutions may be put forth, and pregnant women should be allowed to exercise the right to a leave from their jobs.

The measure of an extended stay in houses and buildings should be in force until the competent organ informs the public that the need for the extended stay indoors has ceased.

Article 14

Purpose-built shelters provide a higher degree of protection as opposed to the extended stay in flats, apartments and buildings, and they facilitate the control over the introduction, implementation and suspension of other protection measures (provision of stable iodine compounds and evacuation).

Article 15

Before taking a decision to administer stable iodine compounds (SPJ), daily intake of iodine through food and drinking water is to be established as well as efficiency of the iodization of salt, the incidence of thyroid gland and lymph nodes malfunction after which contraindications to the administering SPJ are established. Stable iodine compounds are administered to endangered groups of the population if the estimate is that the thyroid gland irradiation will be between 50 and 500 mSv:

1) pregnant women in the vicinity of the nuclear accident site, however this should be restricted within the shortest time limit possible and combined with frequent checkups and relatively longer stay in flats and apartments;

2) pregnant women in their second or third quarter who are in the vicinity or further away from the nuclear accident site;

3) mothers who nurse their infants;

4) small children and children under the age of 16, regardless of whether they are in the vicinity or at a larger distance from the nuclear facility which has caused the contamination, if an assessment is made that the thyroid gland irradiation will exceed the interventional level;

5) individuals over 16 and below 45 yrs of age who are in the vicinity of the nuclear accident site where inhalation is the principal way for radioiodine intake;

6) individuals over 45 yrs of age who are in the vicinity of the nuclear facility until the moment the contamination of air, food and drinking water drops below the critical point; in the process general contraindications to the administration of iodine compounds must be taken into account;

7) outside emergency intervention teams, consisting of men not younger than 18, immediately after the nuclear accident has occurred.

Individual SPJ doses are administered depending on individual age in the amounts (doses) which must be in keeping with recommendations listed in the table below:

Age groups	KJ mg	KJO3 mg	Equivalent iodide dose in mg*
1	2	3	4
Newborn infants less than 1 month old	15	20	12,5
Infants and small children below 3yrs of age	30-35	30-45	25
Children between 3 and 12 yrs of age	65	85	50
Adults (including pregnant women and women breast-feeding their infants) aged between 13 and 16	130	170	100

*

Tablets containing 50 mg of iodide

Newborn infants: 1/4 to 1/2 tablets.

Small children: 1/2 tablets.

Children: 1 tablets.

Adults: 2 tablets

Newborn infants are administered only one dose. Pregnant women and breast-feeding mothers may be administered a repeated dose, while other persons may be administered repeatedly if necessary.

Contraindications for SPJ applications are as follows:

1) known oversensitiveness to iodine, iodine contrast agents and drugs;

2) previously treated or existing thyroid gland disease: endemic or nodular goitre;

3) lymphocytic autoimmune thyroiditis;

4) Hashimoto's thyroiditis;

5) hyperthyroid dermatitis and vasculitis with low concentration of complements.

The reserve stocks of iodine compounds should be kept in a health institution in the vicinity of the nuclear facility – at a distance of 3 to 5 km, so that SPJ may be administered as soon as possible to the entire population.

Workers at the nuclear facility and protection team members must be provided with SPJ as part of their regular protection equipment.

Article 16

Population evacuation in the early phase of the nuclear accident is the last and the most difficult measure which must be undertaken in order to prevent the occurrence of non-stochastic consequences resulting from acute and chronic radiation disease.

Population evacuation measures may be implemented solely in the event of major nuclear reactor accidents and these are to apply to the population in the vicinity of the damaged nuclear reactor.

The following factors should be taken into account in the implementation of the evacuation plan:

1) scope, seriousness and the most important characteristics of contamination;

2) number of residents who must be evacuated as well as their health and psychophysical condition (seriously ill individuals, mentally disturbed persons, pregnant women in the last three months of their pregnancies, small children and children below 10 yrs of age, etc.);

3) existence and condition of traffic network to be used for population evacuation;

4) disposition and capacities of the facilities which should accommodate evacuated population in its entirety, by age categories and by type of disease in case of seriously ill individuals;

5) time of year and weather conditions at the time of evacuation as well as the time of day when the radionuclide discharge first occurred;

6) current weather conditions, weather forecasts and estimates of possible radionuclide pathways;

7) size and type of the settlement as opposed to the most dominant type of occupation of the residents to be evacuated;

8) financial cost of the evacuation.

Article 17

Control of access to the contaminated zone is a preventive measure which precludes irradiation and contamination of persons who have not been primarily threatened or which reduces the repeated exposure to radiation of individuals. The endangered zone is roughly estimated in the

early phase of the accident. Later on it is to be designated accurately by way of dosimetric measurements and evaluation of radionuclide content in samples.

The zone is to be marked with standard signs for radioactive materials. At the access communication lines within the zone the checkpoints staffed with persons on duty and dosimetry teams are to be set up.

2) Protection measures in the intermediate phase of a nuclear accident

Article 18

In the intermediate phase of a nuclear accident, in addition to measures from the early phase of the accident whose continued application is estimated to be justified, the following measures are to be applied:

1) population relocation;

2) decontamination of persons, clothes, footwear, objects and surfaces;

3) food and drinking water control.

Article 19

Population relocation is carried out in order to avoid long-term exposure from accumulation of radionuclides in the form of ground deposition. This measure is usually implemented after the release of radionuclides has ceased. This measure is not as urgent as the evacuation of population, and it may be either long- or short-term relocation.

Article 20

Decontamination of persons, i.e. the exposed parts of the body (skin), is performed if the contamination levels from beta and gamma emitters exceed the values of surface contamination activity corresponding to the intensity of the dose of 0.8 nGy/s gauged on the surface of a hand (100 cm2) at a distance of 1cm from the surface.

Principles and decontamination procedures are laid out in the text entitled "Decontamination of persons" which has been published in conjunction with this Rulebook and constitutes their integral part.

Article 21

Decontamination of clothes, underwear, bed linen, interior surfaces of premises or transport vehicles is performed if the contamination levels from beta and gamma emitters exceed the values of surface contamination activity corresponding to the following values of dose intensity measured at a distance of 1cm from the surface:

1) 0.3 nGy/s for clothes, underwear, bed linen, footwear and personal protection equipment;

2) 0.6 nGy/s for surfaces of premises and interior surfaces of transport vehicles; and

3) 1.0 nGy/s for external surfaces of transport vehicles.

Article 22

If an increase of radionuclides or presence of fresh fission products are detected in natural environment through systematic measurements of radionuclide activity, or if a nuclear accident or radiation danger occur, or if the International Atomic Energy Agency (IAEA) notifies the FRY of a nuclear accident which may threaten its territory; elaborate examinations of food products and drinking water are carried out in order to establish the presence of radionuclides. Based on performed examinations and interventional levels, a decision concerning permits, restrictions or ban on the use of some food products and drinking water is made.

3) Protection measures in the late phase of a nuclear accident

Article 23

In this phase, if necessary, the following protection measures are undertaken:

1) control of access to the vicinity of nuclear facilities where an accidental contamination has occurred (for a zone which has been accurately established);

2) decontamination of surfaces, premises and most important communication lines in the vicinity of the nuclear facility, and, if necessary, in the wider zone in individual locations depending on the monitoring results;

3) control of radionuclide presence in food and drinking water as well as fodder;

4) dosimetric control of workers in agricultural production who may be exposed to ionising radiation.

IV DERIVED INTERVENTIONAL LEVELS OF RADIONUCLIDES 134Cs + 137Cs IN LIVESTOCK FOOD

Article 24

In an emergency, derived interventional levels 134Cs + 137Cs in fodder for livestock nutrition (larger producers from socially-owned farms, cooperatives or in the individual sector) are given for various livestock categories and type of food in the following tables:

1. Derived interventional levels in fodder for cattle and sheep nutrition

Table 1

		Activity levels 134Cs + 137Cs for one day (in kBq)					
Type of animal	Age category	DUi	DUv	DUh	DU by food category		
					A	B	C
1	2	3	4	5	6	7	8
1/	adults	90	8	82	64	011,5	6,5
CATTLE							
2/	offspring	14,5	6	8,5	7,3	0,5	0,7
3/	adults	90	5	85	65,5	12,8	6,7
SHEEP							
4/	offspring	14,5	0,5	14	9,8	2,2	2

where numbers stand for:

1/ dairy cows

2/ beef cattle

3/ dairy sheep and breeding sheep

4/ breeding sheep and lamb

DUi = permitted daily intake by ingestion

DUv = permitted daily intake through water

DUh = permitted daily intake through food (DUh = DUi - DUv)

DU = permitted daily intake by food categories

A = fresh food in bulk (grass, clover, alfalfa, silage)

B = dry food in bulk (hay, straw, leaves)

C = concentrated food (forage)

2. Derived interventional levels in forage intended for swine and poultry nutrition

Table 2

		Activity levels 134Cs + 137Cs for one day		
Type of animal	Production category	DUi (kBq)	DUv (kBq)	DUks (kBq/kg)
1	2	3	4	5
PIGS	adults			
	1/	14.7	1,5	2,2
	2/	14.7	1,5	6
	offspring			
3/	14.7	1.5	3,3	
POULTRY	adults			
	4/	14.3	-	110
	offspring			
5/	14.7	-	210	

where:

1/ breeding sows, 150kg in weight

2/ fattening swine, up to three months of age, below 60kg in weight

3/ fattening swine, seven months of age, below 100kg in weight

4/ laying hens, up to one year old and about 2kg in weight

5/ chickens, between 30 and 60 days of age, 0.5kg in weight

DUi = permitted daily intake by ingestion (food + water)

DUv = permitted daily intake through drinking water

DUks = permitted activity level in forage

Larger producers in the socially-owned, cooperative and individual sector are producers with over 100 dairy cows, 200 head of beef cattle, 100 sheep, 100 breeding sows, 500 head of fattening swine, over 1000 laying hens and over 2000 chickens in one production cycle.

V LIVESTOCK PROTECTION MEASURES

Article 25

In case of immediate danger or actual occurrence of an emergency (early phase, intermediate phase and late phase), in order to protect the livestock production (livestock, fodder, drinking water for animals and facilities for animal husbandry) and plant production (soil, agricultural plants, food storage facilities, irrigation water supply) the following measures are to be taken:

1) preventive radiation protection,

2) radiometric and dosimetric control, and

3) radioactive decontamination.

Preventive radiation protection measures are taken before the actual occurrence of an emergency or immediately after the beginning of the early phase.

Radioactive decontamination measures are taken after establishing by way of radiometric control that radioactive contamination of the natural environment and some parts or the entire food chain has occurred.

Individual protection measures and procedures in biotechnical production are specified in detail in the "Guidelines for radiation protection measures application in an emergency", which are published alongside with this Rulebook and constitutes the integral part thereof (hereinafter referred to as: the Guidelines).

VI RADIATION PROTECTION MEASURES FOR LIVESTOCK PRODUCTION

Article 26

In case of an immediate radiation threat (50 kBq/m2 134Cs + 137Cs) to the livestock production, the following preventive radiation protection measures must be applied:

1) removal of animals from open spaces,

2) protection of sources of water used to satisfy water requirements for animals;

3) protection of fodder in open and closed spaces,

4) hermetically sealing stable premises.

Article 27

The removal of animals from open spaces is the first preventive radiation protection measure which must be carried out as soon and as quickly as possible so that the animals are transferred from open spaces (pastures, meadows, etc.) to closed stable premises.

This measure must be applied within 24 hours from the moment the radiation danger is declared.

Article 28

Sources of water used to satisfy water requirements for animals (wells, springs, etc.) must be immediately protected from radioactive contamination by plastic foil covers (PVC).

Unprotected water sources as well as open geographical waters must not be used to satisfy animals' water requirements.

If there are no protected sources of water, before using open geographical waters, a radiometric control of the water must be performed. Based on the results of such a radiation-hygienic examination, the water may be used to satisfy water requirements for animals, pursuant to Article 25 of this Rulebook.

Radiation protection of water sources used to satisfy water requirements for animals is performed in keeping with instruction laid out in the Guidelines.

Article 29

Fodder in open spaces (meadow grass, clover, alfalfa, pasture legumes, etc.), must be mowed and collected, as soon as possible and before radioactive precipitation, into haystacks, piles, etc. which must be protected with waterproof covers (tarpaulin, PVC-foil, etc.).

Fodder in stored in open storage areas (barns, etc.) must be protected with protective covers (PVC-foil, tarpaulin, etc.), and in case there is a lack of such materials – compact bundles of cornstalks.

Fodder in enclosed storage space must be protected from radioactive contamination by hermetically sealing the storage area. The procedure of hermetically sealing the storage is laid out in the Guidelines.

Article 30

Stable premises are to be hermetically sealed as a mandatory action intended to ensure radiation protection for animals in the event of emergency.

Hermetically sealed stable premises designated for animal husbandry must be ventilated if the stable premises in question are not fitted with air-conditioning filtering and ventilating systems: cattle and pig stables – every 12 hours for up to 1 hour, and poultry farms – every 6 hours for up to half an hour.

Stable premises with regular and air-conditioning filtering and ventilating systems must be hermetically sealed as prescribed in the Guidelines.

Article 31

Radioactive decontamination of livestock is mandatory in the following cases:

a) when animals, whose external radioactive contamination caused by fission products is over three (3) times higher than the level of gamma-phon of the natural environment in the given location, are accommodated in radiation-hygienically clean stable premises; and

b) when external radioactive contamination is detected in slaughter livestock.

Article 32

Radioactive decontamination of animals is carried out using dry, wet or combined methods, i.e. through application of surface active agents (highly expansive foam) as prescribed in the Guidelines.

The organisation unit where radioactive decontamination of animals is performed is the livestock R-decontamination station (SDS), whose organisational structure and work regime are prescribed in the Guidelines.

Article 33

Radioactive decontamination of fodder is performed as follows:

1) auto-decontamination;

2) removal of surface layer; and

3) radioisotope diluting procedure.

Auto-decontamination is performed as follows: radioactively contaminated fodder is stored in a special warehouse where it must remain until after it is established by using radiometric control that it may be utilised for animal nutrition.

Auto-decontamination may be applied to all types of fodder – fresh and dry bulky livestock food and forage mixture.

Removal of surface layer is applied depending on the type of fodder and the manner in which this livestock food is stored. The thickness of the removed surface layer depends on the penetration of radioactive substances and is detected by radiometric control.

Radioisotope diluting procedure is permitted only if the quantity of uncontaminated livestock food is not sufficient until the delivery of new stocks. The procedure entails the mixing of radioactively contaminated livestock food with unexposed clean fodder in a specified ratio in order to achieve the satisfactory level of activity in livestock food so that it may be used for animal nutrition, in accordance with the Article 25 of this Rulebook.

Article 34

In the event of emergency, special procedures and radiation-related hygienic safety measures must be applied in slaughterhouses. These are as follows: dosimetric control, radiometric control, clinical examination of slaughter livestock for acute radiation syndrome (ARS) and radiometric analysis of consumer meat. To this purpose, slaughter livestock control and screening point is to be set up in each slaughterhouse.

Organisation of work at the slaughter livestock control and screening point, organisation of slaughter lines for contaminated animals as well as personnel radiation protection measures are described in the Guidelines.

VII PLANT PRODUCTION PROTECTION MEASURES

Article 35

In case of radiation threat to plant production (50 kBq/m2 134Cs + 137Cs), the following protection measures must be applied:

1) preventive technical-technological radiation protection measures;

2) agricultural technical radiation protection measures in the early, intermediate and late phases, i.e. over the course of duration of the emergency situation.

Article 36

Mandatory preventive technical-technological radiation protection measures for plant production, which are to be applied immediately before the occurrence of an emergency, i.e. before the radioactive precipitation deposition, are as follows:

1) earlier harvesting of specific unripe crops which are subsequently utilised to prepare silage for animal nutrition;

2) earlier picking of plant fruits and their utilisation (if possible) for processing, i.e. preservation and manufacturing final products;

3) protection of collected bulky and concentrated livestock food by means of plastic covers and other waterproof materials.

The measures listed above must be applied promptly and as soon as possible, i.e. before accumulation of radioactive precipitation deposition and at the latest – within 1 to 2 days.

Article 37

Agricultural technical radiation protection measures for plant production in the early and intermediate phases are to be implemented immediately after the radioactive precipitation deposition, i.e. over the course of the entire vegetation period in a production season, and these are as follows:

1) utilisation of greenhouses used for vegetable production (tomato, paprika, cucumber, spinach, salad, etc.) as well as coloured fruit berries (strawberry, raspberry, blackberry, etc.);

2) mowing meadows in order to obtain green mass for animal nutrition: to obtain green mass for cattle nutrition grass is mowed at the level no lower than 15 cm from the ground surface whereas to obtain green mass for nutrition of other livestock – the grass is mowed at the level no lower than 5cm above the ground surface;

3) intensified calcification of arable land;

4) avoidance of phosphate fertilizers, utilisation of nitrogen fertilizers and natural fertilizes instead;

5) adequate processing and land cultivation using new plant cultures;

6) modification of crop production if needed, whereby the selection of plants depends on the type and quality of soil as well as characteristics of plant cultures.

Specific measures are to be prescribed by competent organs in charge of agricultural affairs in a specific area.

Article 38

Agricultural technical radiation protection measures for plant production in the late stage, i.e. the following production season, as well as the next several years, comprise the application of the following measures:

1) removal of crops and residual crop yield;

2) more frequent mowing of meadows;

3) removal of surface layer of soil;

4) deep plowing of radioactively contaminated soil;

5) application of adequate artificial fertilizers and improvement of soil quality;

6) change of crop types and selection the most suitable plant cultures for growing on specific soil;

7) other options for reduction of fission-radionuclide content in plant production.

Article 39

Removal of crops and residual crop yield is a mandatory measure intended to reduce the level of activity for radionuclides that have been accumulated as a component of ground deposition.

This measure is to be implemented as follows:

1) in case of tall crops as well as lush and diverse vegetation, the vegetation mass is removed entirely from the surface of the soil;

2) in case of low-lying, uniform and spread out crops, the vegetation mass is removed together with the 5-10 cm thick layer of soil.

Further vegetation mass removal procedure may be carried out using any of the following methods:

1) burying – which requires a large area and is not practical given the amount of the vegetation mass;

2) baling – which may be executed solely with the use of mechanisation.

In the implementation of the vegetation mass removal procedure, adequate protection measures for the personnel removing the vegetation mass (protective clothing, clothes and personal masks) must be undertaken.

Article 40

More frequent mowing of meadows is implemented as a measure intended to reduce the fission radionuclide content in the ground.

Mowed grass and hay may not be utilised for animal nutrition until after radiation-hygienic examination.

Article 41

Removal of 5 cm-thick surface ground layer is a measure which is to be implemented on smaller plots of land with the purpose of reducing the fission radionuclide content in the surface layer of the ground.

Removed surface layer is piled up at the edges of the plot of land and is not to be used for plant growing.

Further utilisation of this land shall not be possible until after radiometric examination and positive opinion by competent agricultural and technical experts.

Article 42

Deep plowing is intended to enable the radioactively contaminated soil for the plant production.

The soil may be plowed at different depths: 10 cm, 20 cm and 30 cm.

Plants with shallow root system or the root system deeper than 10 cm are grown on the soil which is plowed at the depth of 10 cm, whereas plants with shallow root systems as well as plants with very deep shallow system may be grown on the soil which is plowed at the depth of 20-30 cm.

Plowing may be combined with irrigation where solutions of adequate salts may be applied by means of powered sprinkler systems.

Agricultural experts are to decide on the application of this measure and the selection of plant cultures.

Article 43

Application of artificial fertilizers is intended to increase the quality of the soil and the presence of large quantities of calcium, sodium, phosphorus and potassium in order to reduce resorption of fission radionuclides.

Agricultural experts must be consulted on the selection and quantities of artificial fertilizers, which depends on the characteristics of the soil and specific properties of plant cultures.

Article 44

Change of crop type is a method combining a specific type of plowing and growing a plant culture which will resorb the least fission radionuclides deposited in the soil.

This measure is to be applied exclusively in consultation with agricultural experts.

Article 45

Other possibilities for the reduction of fission radionuclide activity level in the process of plant production may be divided into two groups:

1) procedures which are applied in the phase of plant culture growing:

a) limitation of irrigation using the water from open geographical water currents, if the activity level of such waters is above the permitted limit. Irrigation of soil may be allowed solely after radiometric examination of water and in consultation with crop experts;

b) reduction of underground water levels intended to help soluble fission radionuclides penetrate faster the deeper layers of soil beyond the reach of root systems of cultivated plants;

2) procedures which are applied in the next production period:

a) selection of specific plant cultures depending on the quality of soil and degree of radioactive contamination;

b) application of adequate agricultural and technical measures.

Procedures listed in this article may be applied solely after consultations with agricultural experts.

Article 46

Radioactive decontamination of soil as a palliative measure is to be implemented as prescribed in Articles 39, 41, 42 and 43 of this Rulebook.

Article 47

Radioactive decontamination of plants and plant yields is primarily related to external radioactive contamination of vegetables, fruit, etc.

Radioactive decontamination of plant cultures in an open space, due to the size of large tracts of land, is for the most part effected through natural occurrences, i.e. washing away caused by precipitation (rain) which is not radioactively contaminated.

If irrigation by way of sprinkler systems is used in areas where certain plant cultures are grown, this irrigation system itself also serves as an appropriate procedure for decontamination of these plant cultures provided that the used water has a low level of activity.

Plant fruits (vegetables, fruit, etc.) which are intended for sale (in green markets, etc.) are subject to radioactive decontamination as described in the Guidelines.

VIII CONCLUDING PROVISION

Article 48

This Rulebook shall enter into force on the eighth day following that of its publication in the Official Gazette of the Federal Republic of Yugoslavia.

Table 1

PROTECTION MEASURES FOR EACH PHASE OF NUCLEAR ACCIDENT

Early phase	Intermediate phase	Late phase
Protective screening and application of makeshift protective respirators	Protective screening	

Use of stable iodine compounds	Use of stable iodine compounds	
Evacuation	Evacuation	
Access control	Access control	Access control
	Population relocation	
	Decontamination of individuals	
	Control of food and drinking water, and use of spare fodder	Control of food and drinking water, and use of spare fodder
	Medical protection	
		Decontamination of surfaces/space

Table 2

PROTECTION MEASURES CONTINGENT ON IONISING RADIATION EXPOSURE PATHWAY TYPES

EXPOSURE PATHWAYS	AVAILABLE MEASURES
External exposure from radioactive plume	Protective screening, evacuation, access control
Internal exposure to radiation by radioactive plume inhalation (internal contamination)	Protective screening and application of makeshift respirators
	Use of stable iodine compounds, evacuation and access control
External contamination of individuals by radionuclides deposited in the ground from plume or ground deposit radionuclides	Protective screening, evacuation and population evacuation, access control and decontamination
Internal exposure by resuspended radionuclide inhalation (internal contamination)	Evacuation, population relocation, access control and decontamination
Internal exposure to radiation by ingestion of contaminated food and drinking water (internal contamination)	Control of food and drinking water, and use of livestock food stocks

DECONTAMINATIONS OF PERSONS

In primary and final decontamination phases whose implementation is, above all, conditioned by the accident itself and the possibility for carrying out decontamination procedures, the basic principles in the process of assessing of real danger from contamination itself in terms of received doses, estimating possible decontamination procedure effectiveness and assessing risk from inadequately performed decontamination are to be adhered to. The possible danger is the fixation of radionuclides and the absence of further effect or the occurrence of skin irritation in case when it

is impossible to further implement the procedure. Particular attention is to be focused on the prevention of contamination expansion to clean areas, which aggravates and lengthens the procedure, then on skin irritations caused by the very decontamination procedure, which is why it is necessary to have in place a well developed methodology for decontamination in case of larger-scale accidents.

Certain physical and chemical characteristics of decontamination substances may have specific impact in terms of their efficiency, but they may also step up the resorption of radionuclides through skin. Some organic solvents and complex compounds which are used for skin decontamination increase the content of radionuclides in an organism as a result of increased resorption.

To achieve efficiency is important as this saves time. Prevention of internal contamination also simplifies the medical treatment. Chemical stability of substances used for decontamination is of great importance in terms of the possibilities for their storage.

a) Soaps – to be used for partial and complete decontamination.

The most convenient for the purpose are toilet soaps in small 20 gr packaging. They are used in the form of soapsuds which are created directly on the surface of a moistened piece of soap or they may be applied in the form of 1 percent solution (20 gr of soap in 2l of water).

b) Detergents which are not skin irritants – to be used in decontamination of certain parts of the body, but to be avoided for the purpose of the decontamination of the entire body. Detergents designated for washing fine white linen are recommended for this purpose. Detergents are to be dissolved in water before use. Ten grams of detergent is needed for 1l of water (1 percent detergent solution).

v) Liquid soap – to be used primarily for partial decontamination. It is to be applied directly without dissolving.

Norms for consumption of decontamination agents

The following norms for consumption of decontamination agents are recommended:

a) Liquid soap in 20 gr packaging satisfies the needs for partial and complete decontamination of one individual. The consumption of soap and subsequent rinsing with water in case of complete decontamination in case of group decontamination amount to 15-20gr of soap and 10-20l of water per person respectively.

b) Detergents are to be used as 1 percent solutions. The consumption of detergent solution for decontamination of a hand (about 300 cm^2) amounts to 1 litre and about 1 litre for 2-3 treatments.

v) Liquid soap is used solely for partial skin decontamination – 5 ml for 300 cm^2. The consumption of water amounts to about 1 litre for 2-3 treatments.

Partial decontamination is performed with moistened cotton wool balls tampons. For the treatment of a hand about 30 cotton wool tampons (15 gr of cotton wool) is required.

Possibilities for utilising decontamination substances

If undamaged skin is contaminated by fission products, it is possible to use the following decontamination agents:

I Partial decontamination:

- soapsuds made by toilet soaps or 1% solution of soap in water;

- 1% solution of detergent in water;

- liquid soap without dissolving;

- other agents may be used in specialised health institutions.

Decontamination solutions should have a pH value between 7 and 8.5, whilst the temperature of the solution and rinsing water should be between 20-30 C.

II Complete decontamination, which is performed in case of diffuse type of contamination or as final treatment after locally performed decontamination, entails the use of toilet soap – 20 gr per person. Detergents should be avoided due to possible irritation and allergy. The temperature of water as the rinsing agent should be 25-35 C depending on the season of the year and circumstances in which the decontamination is performed.

In the decontamination process, radiation levels on the exposed body parts of an individual as well as contaminated places and contamination levels should be gauged first using a sensitive radiation monitor.

The following substances and procedures should be used for the decontamination of exposed parts of the body:

1) Toilet soap (if possible, in 20 gr packaging) should be primarily used. Create soapsuds with moistened cotton wool tampon and wipe the contaminated surface of the skin starting from the least contaminated spot and work your way up to the place where the contamination level is the highest. Tampons must not be utilised again after the first use. They should be placed in bags designated for radioactive waste materials. The same surface should be cleaned in the same manner using tampons soaked in clean water and dry it with another cotton wool tampon. The cleaning process lasts about one minute. Monitor residual activity degree using a detector and record the values (the person operating the detector is to record the values) and repeat the procedure, if necessary, once again. The decontamination process lasts in total 5 minutes.

2. If there is no soap, then detergents are to be used. Prepare 1% detergent solution (10 gr of detergent or two teaspoonfuls of detergent in one litre of water). Wipe the contaminated surface of the skin with a tampon soaked in the detergent solution starting from the least contaminated spot and work your way up to the place where the contamination level is the highest. Tampons should be placed in bags designated for radioactive waste materials. The same surface should be cleaned in the same manner using tampons soaked in clean water and dry it with another cotton wool tampon. The cleaning process lasts about one minute. Monitor residual activity degree using a detector and record the values (the person operating the detector is to record the values) and repeat the procedure, if necessary, once again. The decontamination process lasts in total 5 minutes.

Primary decontamination

After providing urgent medical assistance, if necessary, start with primary decontamination:

- Measure and record the decontamination level in a specially prepared form or anatomic diagram;

- Remove all the clothes, shoes and personal belongings, and place them in plastic bags;

- Remove all visible impurities and, if possible, wash the patient but protect the wound;

- Rinse out bodily cavities with water or physiological solution, and do not allow the contaminated person to swallow anything.

Principles and rules of decontamination

1. Just like with primary decontamination, at a health institution that has received a contaminated person for further treatment, attention is to be focused on his/her general health condition and resuscitation if necessary.

2. Decontamination procedures comprise physical removal of radionuclides from skin, wounds and bodily cavities.

3. Decontamination is performed in the following manner:

a) Start from the least contaminated spot and work your way up to place with higher contamination levels. An exception to this are more contaminated wounds and burns. Start decontamination of

head, face, neck and hands where the contamination levels are usually the highest, and then proceed with other bodily parts.

b) A mobile patient without injuries shall take a shower.

v) Start with the simplest methods, and then use more complex procedures.

g) Decontamination effectiveness is controlled by way of a radiation monitor on the basis of which the team leader decides when to stop.

4. Personnel in charge of decontamination should be adequately protected (personal dosimeters, protective clothing, shoes covers, etc.). Particular attention should be focused on the prevention of transfer of contaminated materials to clean parts.

5. In order to assess the external and internal radiation levels, types of radionuclides and received radiation doses, before and in the process of decontamination the samples of the material is to be taken for radiation and biological analysis:

a) Samples of the material containing external contaminants (smears, clipped nails, tissue samples, bodily fluids after decontamination, wound samples, etc.);

b) Samples containing internal contaminants (blood, urine, faeces, sputum, nasal cavity sample, etc.);

v) In case of neutron radiation, personal belongings made of metal due to induced radioactivity (wristwatches, rings, bracelets, earrings, etc.);

g) Haematological samples (blood in clean test tubes, in test tubes with heparin, with oxalate, peripheral blood smears…).

All the samples must be properly packaged in plastic bags, test tubes or other receptacles and accurately marked.

Wound decontamination

A contaminated wound is not to be touched (do not implement any decontamination procedure).

- The wound must be protected from further contamination (in the process of skin decontamination for a contaminated person).

- Protection is to be provided, if the wound has already been dressed, by way of covering it with plastic foil and positioning it firmly (with adhesive strip or rubber bands on extremities) so as to prevent any additional contamination of the wound.

- The wound decontamination is to be carried out by a doctor (surgeon) in the course of the primary wound treatment procedure.

Decontamination of external ear canal

- Take a sample using cotton-wool sticks or Q-tips and gently rinse it out with smaller amount of water;

- Measure activity and, if necessary, repeat the rinsing procedure.

Decontamination of nasal cavities and mouth

- Turn patient's head aside or downwards;

- Gently rinse them out with a smaller amount of water;

- Patient should not swallow anything;

- If radionuclides have been ingested, use the nasogastric tube to assess radioactivity of the sample from the stomach. If the content is radioactive, then the following steps should be taken:

- Pump out the stomach content using smaller amounts of physiological solution until radioactivity is reduced to acceptable levels;

- Start the procedures of eliminating radionuclides from the organism.

Decontamination of hair

- Wash hair with soap or shampoo but take care not to allow contamination to reach eyes, nose or mouth;

- If repeated washes of hair have no effect, then the hair should be cut short.

Decontamination of skin

Decontamination of healthy skin using soaps and detergents has been described above. It is necessary to apply the following procedures:

- Using a moistened handkerchief take a smear from the skin surface of about 100cm^2;

- Use surgical sponges and soft brushes which do not irritate skin;

- If using sour soaps, cover the contaminated segment with heavy soapsuds, leave it like this for 2 to 3 minutes, and then rinse out with plenty of running water; the remaining activity should always be gauged and recorded;

- The procedure may be repeated once, but take precautions to avoid the occurrence of skin rash or wounds to the skin;

- In case contamination persists, use hydrogen peroxide;

- In case of persisting contaminations, use abrasive agents which may physically remove fixed contamination: abrasive soap, a mixture of titanium dioxide and lanolin. After the application of all these agents, hands are to washed and protected with some of the protective creams (“Lek 48”, vaseline, Octa, Nivea, Borogal, etc.).

- To remove the upper surface with remaining contamination, a solution of potassium permanganate may be used. It should not be applied near wounds, eyes or mouth. The solution is to be poured over moistened skin and carefully rubbed in using a soft brush for about two minutes, after which the skin is washed with water. Stains are to be removed using potassium sulphate (5 gr NaHSO3 in 100 ml of distilled water), rinsed out with water and dried, after which protective cream is applied. The following substances may be used for different radionuclides:

- for uranium – sodium bicarbonate;

- for fission products, lanthanides, plutonium and super heavy elements – use 1% solution of DTPA (ph 3-5);

- for alkaline and alkaline-earth elements – use water.

If there are injuries to the skin and strontium contamination, the strontium is transformed into an insoluble form by using K-rodizonate.

Application of agents containing no water for skin decontamination

If there is no liquid soap available, non-water substances may be used for decontamination using the following procedure:

- wipe the contaminated surface of the skin using tampon soaked in liquid soap starting from the least contaminated parts and working your way up to the parts with the highest contamination levels; dry the skin with cotton wool tampons and control the remaining activity level; the cleaning process lasts about 1 minute; repeat the procedure one more time;

- mix corn flour and detergent to make paste and use it as an agent (with no water) in a situation when running water is unavailable;

- mixture of 8% carboxy-methyl cellulose, 3% detergent, 1% CaEDTA and 88% of water, homogenised as cream, may be used in special circumstances as a non-water decontamination agent.

Internal decontamination

Of the agents that may be used for internal decontamination in specialised health institutions the following ones are listed below:

- alginates; administration method: - *per os* 10 gr (1x per day).

The treatment continues in the following days using four 4 gr doses per day.

- Isotonic sodium bicarbonate; administration method: 250 ml in perfusion i.m. apply gently;

- Prussian blue (ferriferous cyanide); administration method: per os: 3-4 gr PP in a small amount of water distributed in three doses.

DTPA (Diethylenetriaminepentaacetic acid); administration method: 0.5 gr in perfusion i.m. apply very gently in isotonic solution (250 ml NaCl 0.9% or 5% glucose). The treatment is to be extended for several days depending on the degree of contamination levels. The dose should not exceed 0.5 gr a day, while the administration frequency is to be determined depending on specific characteristics of each individual case. Through respiratory system: DTPA aerosol inhalation every half hour which is prepared using one ampoule of solution (1 gr in 4 ml) or one capsule of powder (1 gr is placed in aerosolizer of the spinhaler type).

It is recommended to administer Ca DTPA at the beginning of the treatment as it is a more efficient agent, whereas later on, in the first week of the treatment, Zn-DTPA should be administered through skin, being a less toxic agent, which is then rinsed out, after application, with 1% DTPA acid solution.

- Cobalt gluconate; administration method: Sr-lactate is administered *per os*, 500-1500 mg in several portions a day to be ingested, if possible, in the middle of a meal. Sr-gluconate is administered i.m. in gentle perfusion where 600 mg are dissolved in 500 ml isotonic solution of 5% glucose.

- Iodine; administration method: 375 mg KJ or 2 ml of lugole dissolved in a glass of water. The treatment should continue in the next several days depending on the degree of contamination, 1-2 ampoules of LSl or 1 ml of Lugol a day.

- Rodizonate; administration method: apply 1 gr of radizonate to the contaminated wound before the surgical treatment.

GUIDELINES FOR APPLICATION OF RADIATION PROTECTION MEASURES IN CASE OF EMERGENCY

In there is a likelihood that a radiation-related emergency, i.e. radioactive contamination of natural environment and food chain, may occur, in order to achieve preventive radiation protection or reduction of radioactive contamination, biotechnical experts shall undertake radiation protection measures in livestock and plant production which are prescribed in these Guidelines.

1. Radiation protection of sources of water for animal consumption (Article 29, paragraph 4)

In order to achieve radiation-hygienic protection of open wells it is necessary to have the existing wells walled in and enclosed within a fence made of solid material (at least 1m high) as well as protected with eaves and a lid which seals the well properly. There must be a surface area made of concrete or bricks surrounding the well. If this is not the case, a 20 cm thick and 2-3m wide layer of clay must be placed around the well. This embankment must have a gentle slope leading towards the drain canal channelling the drain water away from the well.

Artesian and conventional wells, drinking fountains and springs must be covered with PVC foil or similar waterproof material (tarpaulin, canvas, etc.) and tied with a rope so that wind would not blow away the protective cover.

When using the water for animal consumption from the conventional water supply system or other closed water systems, there is no need to take radiation protection measures since this is regularly performed by the competent services.

2. Sealing space for livestock food storage (Article 30, paragraph 3)

Hermetically sealing the space for storing livestock food, which is packaged in sacks (forage, etc.), is performed by sealing all the openings in the facility (doors, windows, ventilation openings, etc.).

Windows are to be sealed with adhesive tapes. If these are not available, use cut-out paper strips (10 cm wide) which have been soaked in a watery flour mash before being glued along the edges of window panes.

Doors and ventilation openings (particularly the ones utilised for incoming fresh air) are sealed by way of specially designed wooden frames to which a layer of sackcloth (or similar porous material) is attached on both sides, whilst some loose material (hay, straw, wool, etc.) is placed inside. Such protection filters are placed in front of and behind the doors, whereas PVC foil is applied on the front side.

Protective filters are controlled every two or three days using some radiation monitor (e.g. KOMO-TM, KOMO-TN, KOMO-TL and others). In case gauged activity levels are 10 times higher than the radiation levels in the interior of the livestock food warehouse, filtering frames are replaced by new ones.

Radioactively contaminated filtering frames may be decontaminated and re-used after radiometric control if the radiation levels are within the permitted limits.

After decontamination of frames, loose material (hay, etc.) should be replaced by uncontaminated material.

3. Sealing stable premises (Article 31, paragraph 3)

Radiation protection of stable premises which are used for animal husbandry is carried out by sealing (hermetically) all openings of stable premises (doors, windows, ventilation openings…).

1) Sealing procedure

To hermetically seal stable premises makeshift material may be used (polyvinyl foil, hemp, felt, impregnated canvas, blankets, tarpaper, reed mats, wooden panels, etc.).

Sealing of windows may be performed by using adhesive tape or cut-out paper strips (10cm wide) which have been soaked in a watery flour mash before being glued along the edges of window panes. To the same purpose, wooden panels or tarpaper may be utilised, whereas cracks are sealed with clay mud.

Sealing of doors is performed by sealing all the cracks in the doors and door frames with cloths and similar material, after which clay mud and adhesive tapes are applied.

In the facilities used for industrial farming (cattle breeding), in order to implement radiation protection particular attention must be focused on the entrances to every stable facility. Entrance doors are protected from the outer environment by way of constructing special chambers: a) outer chamber on the outer side of the entrance door; and b) inside chamber on the interior side of the door. Chambers are constructed of wooden planks and coated with polyvinyl foil. The entrance chamber must have two segments: the first antechamber – for leaving the clothes and footwear, and the second antechamber – for putting on working clothes and footwear in the stable facility.

The size of the outside and inside chambers depend on the size of the entrance door.

Ventilation openings are sealed in the same manner as the openings in livestock food storage facilities.

2) Securing proper microclimatic conditions

The process of hermetically sealing the stables used for cattle farming also causes a series of problems related to the microclimate of the stable facilities, which inevitably affect health, producing capacities and quality of livestock products, i.e. the quantity, quality and consuming value of food of animal origin.

In order to overcome unfavourable microclimatic conditions in hermetically sealed stables which are not equipped with filtering and ventilating systems, it is necessary to ventilate stable premises every six hours for half an hour. Such a procedure may be permitted since it is well known that inhalation is not a significant biologically-relevant radionuclide intake pathway for livestock.

If there is an automated filtering and ventilating system in the stables for intensive cattle farming, all the difficulties related to microclimate in the facilities are reduced to the minimum provided that the ventilation openings in the stables are protected with filters whose construction has been described in the section related to the sealing of doors in livestock food storage facilities.

Cattle may put up very well with difficult conditions of life in hermetically sealed stables without automated filtering and ventilating systems. Cattle may stay in hermetically sealed stables up to two or three days without suffering from any health- or production-related adverse consequences.

Pigs put up very well with difficult conditions of life in hermetically sealed stables without automated filtering and ventilating systems without any detrimental consequences for up to two days.

Poultry is very sensitive to changes in the microclimate changes because their organisms do not possess reserve adaptation potential, hence, they cannot adjust to bionegative changes in the microclimate. Poultry may remain enclosed on the poultry farm without filtering and ventilating system no longer than 12 hours if the poultry farm premises are not ventilated. If the poultry remains longer in hermetically sealed space without ventilation, the lives of 50% of the poultry shall be under serious threat. Also, after the end of the period during which the poultry farm premises have been hermetically sealed, great sensitivity in poultry shall occur as a result of which any additional stress may cause death (particularly in case of transport). In addition, the changes to production capabilities in poultry are particularly conspicuous, and may result in up to a 70% decrease of eggs laid by laying hens. Such a condition may persist for several more weeks.

4. Radioactive decontamination of livestock (article 33)

For the procedure of radioactive (R) decontamination of livestock (particularly the livestock intended for slaughter) in case of emergency, uniform principles for the organisation of space and work in the livestock decontamination station (SDS), the procedures for performing decontamination as well as equipment, personnel and protection of workers operating in the SDS must be applied.

1) Organisation of space at SDS

When setting up an SDS, one must take into account the selection of location, the quality of soil, exposure dose rates in the SDS area, access roads and other relevant radiation-related and hygienic issues.

The location for setting up an SDS may be outside the area plagued by contagious diseases that may affect livestock and humans.

The plot of land where an SDS is to be set up must be levelled and it must have good permeability and filtering capacity. Sandy locations are the best for this purpose.

Access roads must be connected to a network of traffic arteries, but at a distance of at least 300 metres from the traffic network.

The permitted exposure dose rate (X) on a radioactively contaminated site (KONZ) must be lower than 3.5 nC/kg s (i.e. lower than 50 mR/h).

The size of the space needed for the SDS development depends on the type and number of endangered animals that must be processes at SDS. In principle, 6-10 m^2 are needed for a head of cattle, while 2-4 m^2 per head would suffice for sheep and pigs.

Adequate water supply is a decisive factor when setting up an SDS, which is why the SDS is to be located in the vicinity of running or stagnant waters in the relevant geographic area (rivers, streams, brooks, lakes, etc.) or other natural or artificial sources of water (artesian wells, catchment areas, etc.). For the processing of different types of livestock varying quantities of water are needed: between 20 and 30 litres per head are needed for large livestock, while about 5 litres per head are required for pigs.

2) Organisation of livestock decontamination station (SDS)

The entire space within SDS is divided into two sections: a) "contaminated section", which encompasses two thirds of the entire space of the SDS: depot for collecting radioactively contaminated animals, R-decontamination point, dosimetric control point for the performed decontamination procedure, and b) a "clean segment" encompassing a third of the entire SDS space: depot for collecting decontaminated animals, veterinary assistance point and clean stable area.

In the immediate vicinity of the SDS there is also a reception and screening point for animals at risk as well as a livestock slaughter point in the field conditions.

The screening point for animals at risk is situated adjacent to the SDS so that veterinary health inspection and dosimetric control of animals may be carried out. From this screening point the animals move through a passageway to the depot for herding contaminated animals.

The depot for collecting contaminated animals serves to collect the animals which are to be subjected to the decontamination procedure. This depot must be spacious enough to accommodate at least 20 large animals and a corresponding number of small animals. From this depot, through a passageway, the animals are transferred to the R-decontamination point.

The R-decontamination point consists of one or several "columns" 0.8-1 metre wide where the livestock decontamination procedure is performed. The number of columns for the livestock processing depends on the SDS planned capacity whereas the length of the column may not be less than 10 metres in order to prevent the transfer of contaminated materials to the clean segment of SDS. Along the decontamination column a ditch, 30-40 cm wide and 0.5m deep, is dug out, and it is intended to drain waste waters into the collection pit which must be 50-100 metres away from the SDS and its capacity must be at least 15-20m^3 of waste water.

Several decontamination columns converge on a single column, 1m wide and 3-5m long, through which decontaminated animals move towards the performed decontamination control point.

The dosimetric control point for the performed decontamination is a space where radiometric control of the performed R-decontamination for all individual head of livestock. The control is carried out by means of a radiation monitor. Animals with the positive effects of decontamination are directed through the passageway into "the clean segment" of SDS, whereas the animals with unsatisfactory decontamination effects are returned to the decontamination point where the animal processing is repeated.

The collection depot for decontaminated animals is similar in terms of its size to the collection depot for contaminated animals. From the collection depot for decontaminated livestock the animals are transferred through the passageway towards the immediate veterinary assistance point.

The immediate veterinary assistance point is a space which is twice smaller than the collection depot for decontaminated animals. This veterinary assistance point is at a level of a veterinary centre equipped with necessary instruments and drugs needed for the provision of urgent veterinary assistance to animals which are to be accommodated in clean stable premises.

Clean stable premises are to be situated close to the SDS, i.e. at a distance of at least 500m from the SDS.

The livestock slaughter point in field conditions should also be situated close to the SDS, i.e. at a distance of at least 300m from the SDS. Operations at the livestock slaughter point are to be carried out in keeping with radiation-hygienic procedures applicable to the livestock slaughter process in communal and industrial slaughterhouses at the time of a specific radiation-related event.

3) Work organisation at SDS

The processing of animals which have been radioactively contaminated must be carried out as soon as possible after the contamination has occurred.

Animals arriving from the radioactively contaminated territory (KONZ) are subjected to the screening process before entering the collection depot for animals at risk at the SDS. The purpose of the screening process is to assess the degree of radioactive contamination and the resulting consequences, the usability of animals (working capabilities, production capabilities, consuming value of livestock products) as well as the necessity to slaughter animals which have received semi-lethal or lethal radiation doses. Based on the results of the dosimetric control, the animals are classified into two groups:

- the first group consists of animals which are not radioactively contaminated or are contaminated within the acceptable limits. Other animals which have been injured in another manner also fall into this category;

- the second group consists of animals in whose skin-and-hair cover the presence of radionuclides has been established and where the level of radionuclide activity exceeds the acceptable level.

The decisive factor in the dosimetric control process is the allowed exposure radiation dose rate (X), which is expressed in SI units C/kg, s, or non-SI units - R/h or mR/h.

After the dosimetric control, the unharmed animals from the first group are sent to the uncontaminated area or clean stable premises for further livestock farming, whilst injured animals are sent to the veterinary assistance point. The animals from the second group are subjected to the SDS treatment.

4) Radioactive decontamination procedure

Slaughter livestock radioactive decontamination may be performed by using the following methods: a) wet method, b) dry method, and c) combined method.

The wet decontamination method (bathing, washing, watering) is applied at SDS, but the procedure may be used solely over the course of warmer months, i.e. when outside temperature does not fall below + 10 C.

In principle, the decontamination solution is poured over the entire outside surface of the animal body for 2 to 3 minutes, and then rinsed for 2 minutes with clean water or to the point where the decontamination solution is fully rinsed out.

The livestock decontamination processing begins with the tail, after which the tail is tied, and then other parts of the body are processed in the following sequence: head, neck, chest, trunk, rump and, finally, extremities. The processing is performed first on one side and then on the other, or if the animal processing is carried out by two persons, then both sides are processed simultaneously. Ultimately, eyes and mucous tissue of mouth and nose should be rinsed using 2-3 percent solution of sodium bicarbonate.

For the wet processing of pigs, sheep and calves, a cage accommodating 8 to 10 head of such livestock may be set up in the SDS contaminated segment for the purpose of group decontamination.

Clean water or water with an addition of 3-5 percent detergent or sapo calinus is utilised for decontamination.

After completing the wet decontamination procedure, animals are sent to the clean segment of SDS where they must be dried with clean cloths, sackcloth, etc.

In colder conditions animals should be thoroughly dried, but without massaging.

The dry animal decontamination method is to be applied in colder months as well as if there is no water.

Radioactive dust is best removed from the surface of the animal's body by way of a dust vacuum cleaner. If such devices are not available, contaminated animals should be kept in the area restricted to the contaminated animals only and they should be mechanically processed by utilising brushes with handles 80-100cm long. Subsequently, wet cloths should be used to rub heads, necks, trunk and extremities of animals and dry them using clean cloth or sackcloth. For this part of the process cloths must not be dipped in water containers. Instead, water is poured from the containers on cloths and these cloths are to be rinsed and strained several times.

In wintertime pure snow which is rubbed into the body of an animal using a brush, cloth or a sheaf of hay, which is then thoroughly brushed out, may be used to perform dry decontamination of animals. Eyes, nostrils and oral cavity are rinsed out using 2 percent solution of sodium bicarbonate or 0.2 percent solution of potassium permanganate.

Sheep, instead of dry decontamination procedure, may be simply fleeced.

Radioactive decontamination without the use of water implies the application of decontamination agents in the form of a paste. Of these agents the most often used are: 1. decontamination paste by Zenger (a mixture of equal parts of powder detergent or soap powder and corn flour with added water to achieve the consistency of the paste); 2. kaolin paste by Zlobinski (64% of kaolin, 15% of domestic soap in the form of 40% solution, 3% of Na2CO3 and 18% of water).

The combined decontamination method which involves a combination of both wet and dry methods is applied depending on the circumstances in a given situation. Therefore, for example, if there is a lack of water, animals' heads, necks and trunks are processed using the dry method, while the extremities are processed using the wet method, i.e. by pouring water.

Efficient R-decontamination of animals is also achieved through the use of surface active substances (so-called highly expansive foams), whereby the foam is applied to the entire body of the animal and is left for 2-3 minutes, after which it is removed by brushes with long handles. Finally, the animal is rinsed out with clean water.

5) Equipment for work at SDS

Special devices producing the pressure of water and decontamination solution of 2-2.5atm may be used at SDS to perform the wet procedure. If such decontamination devices are not available, other machines may be utilised instead, like powered and manual water pumps, sprinkler systems and other agricultural machinery.

6) Personnel for work at SDS

Only the persons who have completed the special training course in livestock R-decontamination procedure and the members of specialised units of Civilian Defence (CBRN decontamination units and veterinary protection units) may work at SDS.

7) Protection of workers at SDS

When resorting to any of the above-mentioned methods of livestock R-decontamination, adequate measures for the protection of personnel working at SDS must be taken. SDS operating officer must look after the individual protection of workers at SDS (masks, protection clothing and footwear, gloves, rubber aprons). Also, while working at SDS the standards related to the amount of time the workers are allowed to stay without any harm to their health (Tbb) are to be strictly

applied. In addition, in the summer months, the norms related to the work performed by personnel using protection equipment and clothing and outside temperatures must be observed. Hence, the allowed working hours vary depending on the outside temperatures: over 30 C = 30 min, 20-30 C = 45 min-1 h, 15-20 C =2 hrs, 10-15 C =4 hrs and below 10 C = over 4 hrs.

5. Organisation of work in slaughterhouses in case of emergency (article 34)

1) Slaughter livestock screening point

Three procedures are performed at the slaughter livestock screening point: dosimetric control of external radioactive contamination, radiometric control of internal contamination and clinical examination in order to detect the existence of acute radiation syndrome (ARS).

The dosimetric control is intended to help establish if the slaughter animals are contaminated externally with radioactive substances. The dosimetric control is applied to every head of livestock. This control may be carried out when unloading the animals from a transport vehicle and immediately after their leaving the livestock depot. The time required for the dosimetric control is between 2 to 3 minutes per head. In the course of the examination process, every head of livestock which is suspected of being externally contaminated is isolated in a special section of the livestock depot for a more detailed examination.

The dosimetric control is performed by means of special nuclear gauges – the radiation monitors with which veterinary centres and inspection teams as well as the Civil Protection units are equipped.

The dosimetric control procedure is as follows: a person carrying out a dosimetric control by using a radiation monitor, is slowly moving the Geiger-Mueller tube with a counter about 5cm above the surface of the animal's hair covering, particularly in the area of upper parts of the body – head, neck, back and rump. In this manner the exposure dose rate of gamma radiation (X) on the surface of the animal's body is determined, and it is expressed in SI unit – pC/kg, s, i.e. a larger unit. The permitted level of external contamination is reached when the exposure dose rate of gamma radiation is up to five times above the so-called "zero level", i.e. the radiation level before the emergency event.

The dosimetric screening is carried out on the basis of results gained by the dosimetric control, and all the slaughter animals are classified into two groups:

- the first group consists of animals where no external contamination has been established;

- the second group consists of animals where external contamination with fission products has been established.

Radiometric control intended to detect internal contamination is necessary with animals since inhalation and uncontrolled diet with contaminated food and water leads to internal contamination in animals. This control is performed by measuring the level of activity in secretion products (milk) and excrements (dung or urine). To this purpose secretion products or excrements from the animal to be examined are placed in a shallow receptacle (jar metal lids may be used or something similar). Then a Geiger-Mueller counter of the radiation monitor is used at about 2-3cm from the surface of the sample to measure the activity. If the instrument shows the result (imp/s) which is more than five times bigger than gamma ions, this means that the animal is internally contaminated with radionuclides.

The ARS clinical examination is intended to establish if the slaughter animals were exposed to a high dose of ionising radiation at the same time when they were radioactively contaminated, or before or after radioactive contamination. On the basis of certain symptoms which are typical of ARS, the clinical examination is meant to establish the existence of symptoms which characterise certain degree of ARS. Thus, for example, the existence of petechial bleeding in the mucous tissue of eyes, nose and mouth as well as in the parts of the body scarcely covered by hair (lower abdomen and between the legs) points to exposure of animals to high doses (lethal dose – LD 100/30). Lack of evident symptoms for a serious case of ARS in half the examined animals points

to the fact that the animals were exposed to the so-called semi-lethal dose (LD 50/30). In these animals one may note depression, insufficient mobility, lack of interest in food, but also almost unquenchable thirst.

The screening procedure for injured animals is performed on the basis of results obtained through dosimetric and radiometric control and the slaughter animals are divided into three groups:

- the first group consists of animals which are not contaminated;

- the second group consists of animals with external contamination;

- the third group consists of animals with external and internal contamination.

The animals from the first group may be sent for regular slaughter directly.

The animals from the second group, before being sent to the slaughter line, must be subjected to the decontamination procedure at the livestock decontamination station (SDS). After the decontamination procedure has been performed, the animals are again subjected to dosimetric control. If the exposure radiation dose rate has not been reduced by at least 70 percent, the decontamination procedure is to be repeated followed by another dosimetric control. The animals from this group where a reduction in the exposure dose rate by about 90% after one decontamination procedure may be sent to the slaughter line for uncontaminated livestock (like the animals from the first group). However, the animals in this group whose exposure dose rate reduction was only 50-80% of the initial radiation value (X) are sent to a special slaughter line for contaminated animals (like the animals from the third group).

The animals from the third group (where internal radioactive decontamination has been established) are sent to a special slaughter line which is organised solely for these contaminated animals.

Based on the performed clinical examination, a clinical screening of slaughter animals injured by radiation is carried, and these animals are classified into three groups:

- the first group consists of animals which have received to a very high radiation dose (lethal dose - LD 100/30);

- the second group consists of animals which have received semi-lethal radiation dose (LD 50/30);

- the third group consists of animals which have received a low radiation dose (less than LD 25/30).

The animals from the first group must be sent to the slaughter line immediately as there is a danger of acute form of radiation disease occurring, accompanied by the spreading of bacteria throughout the animal's organism (radiation bacteraemia), which means that meat cannot be kept for long and may be treated as conditionally usable.

The animals from the second group should be sent to the slaughter line as soon as possible since one half of the total number of irradiated animals will develop radiation disease. If this were the case, the-first-group scenario is applied to these animals as well.

The animals from the third group may be sent to the slaughter line depending on the needs for human nutrition.

All three groups of animals are sent to the slaughter line for uncontaminated animals.

2) Organisation and slaughter procedure for internally contaminated animals

During the emergency, two slaughter lines must be formed in slaughterhouses:

a) a slaughter line for uncontaminated animals;

b) a slaughter line for internally contaminated animals.

If the slaughterhouse in question has no technical-technological capabilities to set up two slaughter lines, then a special operation regime must be introduced. Namely, the animals from the first group

are the first to be sent to the slaughter line, followed by the slaughter animals from the second group, and finally the slaughter animals from the third group.

The slaughter of the animals from the first group is no different from the usual animal slaughter procedure in regular (peace-time) conditions. That is the slaughter line for uncontaminated animals.

The slaughter of the animals from the second group is carried out, depending on the animal categorisation, as follows: at the slaughter line for uncontaminated animals and at the slaughter line for internally radioactively contaminated animals.

The slaughter of the animals from the third group – the animals with internal contamination – is to be performed in a special manner which will be described later.

3) Slaughter line for radioactively contaminated animals

The slaughter line for radioactively contaminated animals is a special slaughter line which must be set up in a separate part of the slaughterhouse and include the following sectors:

1 – slaughter segment;

2 – segment for flaying animal skin;

3 – segment for opening abdomen and tying up internal organs;

4 – segment for extraction of intestines;

5 – segment for cutting the trunk and washing with water;

6 – segment for straining the sides and taking meat samples;

7 – segment for cool storage (refrigerated warehouse);

8 – segment for collection of raw hides;

9 – pit for collecting waste and radioactively contaminated parts of digestive organs including their content (the pit must be large enough);

10 – pit for collecting wastewater.

The slaughter line set up in this manner is necessary so that individual parts (segments) of the slaughter line may be more easily decontaminated after the completed slaughter process for all animals.

The animal slaughter and removal of skin is performed by workers (butchers) who have been trained to do this job and who have also passed through the civil defence course for executing these tasks. The workers in this segment of the slaughter line must not be engaged in another sector of the slaughter line – the segment for cutting the abdomen open, tying up internal organs and extraction of intestines. When removing animal skin, workers' hands and animal hair must not be in contact with the flesh of the carcass. In order to prevent this from happening, the carcass must be well rinsed out with clean water in radiation and hygienic terms. It is very important to immediately take the hide to the place designated for the collection of radioactively contaminated hides.

Workers – butchers, who are responsible for extracting the intestines, must carry out these tasks in such a way that there is no possibility for radioactive contamination of meat by way of the content from the internal organs. Therefore, immediately before removing digestive system, the internal parts should be tied up (ligatures) at the beginning and at the end of each and every internal organ and part of the intestines. Also, all the intestines should be removed together and simultaneously where, in the process, particular attention should be paid so that no internal organ may burst open. Separate removal of individual parts of digestive system and other intestines is forbidden. The waste materials should be cautiously deposited in the pit for collection of waste materials.

After cutting the trunk open, the processed sides should be checked for radiation by radiation monitors in order to establish if external radioactive contamination has occurred during the slaughter process. The carcass sides with 2-3 times higher value than zero phon must be singled out as there is a realistic possibility that the level of radioactive contamination exceeds the permitted limits. Samples must be taken (100 gr from each carcass side of an animal) and these must be sent to radiometric laboratory in order to assess the nutritive value of this animal's meat. These carcasses are stored in a separate segment of the cool storage plant until the moment the results of radiation-hygienic control come in.

4) Radiation protection measures

After completing slaughter procedure for the animals from the third group, i.e. after the completion of the slaughter line process for radioactively contaminated animals, equipment and area where the slaughter procedure unfolded is to be decontaminated. All slaughter instruments and parts of equipment must be decontaminated by washing them in hot water and using soap or detergent. The instruments and parts of equipment are not to be placed in containers with detergent. Instead, detergent solution is to be gently poured onto the slaughter instruments. Every part of the slaughter area for radioactively contaminated animals, after the completion of the slaughter process, must be washed using a strong water stream in order to remove radioactive materials. It would be advisable to use detergent solution for floor cleaning. The detergent solution is to be applied using a bucket with a funnel after which the floor is to be polished using a brush or a broom. Finally, the floor is to be washed with a strong water stream.

Special protection measures for people must be put in place when slaughtering the animals which have been radioactively contaminated. Above all, the workers with no adequate protection clothing and equipment (clothing, footwear, gloves, etc.) must not be working at the slaughter line for radioactively contaminated animals. Also, the workers tasked with decontamination of slaughter instruments and equipment must have, in addition to the above-mentioned protection equipment – protection for their faces in order to protect themselves from splashing water and contaminated material.

Persons in charge of dosimetric control must have personal protection equipment.

All the workers involved in the animal slaughter process must be trained to work in extraordinary circumstances. Their employers and local municipal civilian defence headquarters are responsible for providing such training.

Note that the workers involved in the animal slaughter process in the slaughterhouse are banned from taking food, smoking, drinking potable water or other beverages as well as any contact with their everyday clothes during the slaughter process and meat processing until after its completion.

Protection clothing may be taken off only when a person in charge of dosimetric control performs an inspection of the clothes and footwear and allows them to leave the slaughter area. When taking off protection clothing and footwear, workers must take precautions not to touch the outside surface of their protection clothing or allow contact with the inside surface or parts of the clothes.

After taking off protection clothes, the workers are to have a shower, and they must particularly pay attention to washing properly their hands and faces.

6. Radioactive decontamination of food of plant or animal origin (Article 48, paragraph 4)

Radioactive decontamination of food is a complex issue where particular approach depends on the type, its state of matter (solid or liquid), the condition and amount of food, type and manner of radioactive contamination, radiation intensity and half-life period of radioactive decay for radionuclides which are biologically relevant.

Radioactive decontamination of food of plant and animal origin is essentially the same in terms of the procedures applied in the decontamination process.

When the food is contaminated with short-lived radionuclides (having previously performed the identification of radionuclides, of course), it is not necessary (nor is it economical) to initiate any

decontamination procedure if the radioactive decay half-life of radionuclides in question is less than two weeks and if the food in question may be preserved for a longer period. If this were the case, it would suffice, after the completed radiation-hygienic control, to designate a time limit after whose expiry the food may be used. The food in question should be preserved until the expiration of the set time limit. Before granting approval for consuming the food, it must be subjected to radiometric control and sanitary-hygienic quality assessment.

In case of fresh food of plant or animal origin, if it is radioactively contaminated by long-lived radionuclides or a mixture of short- and long-lived radionuclides which are biologically relevant, then an R-decontamination procedure must be applied. The principle of R-decontamination procedure is as follows:

1. washing food with a pressurised stream of clean water for 5 to 10 minutes;

2. mechanical removal of radioactively contaminated surface layer which is 1-2cm thick; the surface layer which is 1-2 cm thick should be removed from the food items with no solid surface layer, and then apply decontamination procedure with a water stream for 5-10 minutes.

After the completion of the decontamination process, but before granting the approval for use, it is necessary to perform radiometric control and an assessment of consuming value of the decontaminated food items.

In case there is no a satisfactory decontamination effect, the entire R-decontamination procedure is to be repeated, and after the washing the food may be soaked (if sanitary-hygienic conditions allow it) in 1-3 percent solution of some organic acid (acetic acid, wine, lemon, etc.).

If there is no satisfactory decontamination effect even after repeating the entire R-decontamination process, further decontamination activities should be abandoned since at issue here is not only external but also internal (structural) radioactive contamination or a combination of the two (both external and internal).

Canned food of plant and animal origin or food of plant and animal origin in glass packaging or hermetically sealed plastic or similar packaging are well protected from external surface R-contamination. However, in this case it is necessary to briefly wash the packaging using a water stream, and only then take out the food.

The food in packaging which is not hermetically sealed or in other types of open packaging is to be treated as unpackaged food which is to subjected to the R-decontamination procedure as described above.

Radioactive decontamination of milk presents a serious problem. Thus far, no efficient and economical method for R-decontamination of milk has been devised. Therefore, it makes sense to process milk, which is radioactively contaminated above the permitted levels, into milk products like cheese and powdered milk which may be stored and consumed after a certain period of time following the performed radiation-hygienic control.

Radioactive decontamination of meat may be carried out in case of either internal or external R-contamination of slaughter livestock.

With external R-contamination of animals or meat, the most suitable R-decontamination procedure would be to wash each side of the carcass using a pressurised water stream for at least 5 minutes each. If pressurised water stream cannot be used, it is necessary to slowly pour at least 25-30 litres of water on the carcass sides. Wine vinegar may be added to the water in order to create 1-3 percent solution for decontamination.

With internal contamination of meat, R-decontamination may be carried out: a) the meat which is intended to be kept longer (e.g. drying) is to be immersed in brine with an increased quantity of salt where brine is to be changed every 2 to 3 days; b) the meat which is intended for immediate consumption may be radioactively decontaminated only by cooking, and in the process it is necessary to change the cooking water at least twice whereby the cooking water is to be disposed of. In addition, it is recommended to keep the meat in salty water before cooking it for at least an

hour. Other procedures of culinary meat processing (roasting, stewing, etc.) cannot be used for R-decontamination process.

Radioactive decontamination of fish is to be carried out by washing the fish in clean water for at least 10 minutes. Then, the fish head, including gills, is cut off and discarded. The intestines and scales are also removed. If the radioactivity for the fish meat after such a procedure is still above the permitted level, it is to be deemed unfit for human consumption.