

BELARUSIAN EXPERIENCE IN THE FIELD OF RADIATION MONITORING AND RADIATION PROTECTION OF POPULATION AND ROLE OF GOVERNMENTAL AND NON-GOVERNMENTAL STRUCTURES IN SOLVING THESE PROBLEMS

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Analysis of undertaken short term radiation protection measures for Belarusian population

On April 28 and 29, 1986 the Institute of Nuclear Energy of the Academy of Sciences of BSSR (INE) submitted the proposals on implementation of iodine prophylactic measures for the population and on resettlement of the whole population out of 100-km from NPP.

In April 1986 our proposals were not accepted, at the beginning of May only the government decided to implement iodine prophylactic measures and to resettle people from the 30-kilometer zone round of NPP. In the same May several hundred children were brought to clean regions of Russia.

According to the decision of the government of Belarus a scientific and technical commission was organised at the beginning of May. It consisted of an academician N.A. Borisevich, the President of the Academy of Sciences, a professor I.N. Nikitchenko, a professor V.B. Nesterenko, a professor Ye.P. Petryayev, a professor S.S. Shushkevich and a professor Ye.F. Konoplya.

On May 3, 1986 I visited the Chernobyl regions of Belarus together with the group of specialists of the radiation safety service of INE. After that the next letter (dated May 7) was sent to the government with the proposal to resettle the population out of the 100-km zone from NPP and the proposals on another radiation protection measures.

At the end of May 1986 the first map of Caesium-137 deposition on Gomel region was made at the Institute. According to its data the population of southern regions of Belarus (50 to 70-km zone from NPP) was additionally resettled from June 5 to June 10, 1986.

During first months after the accident, after making a decision to resettle inhabitants from affected districts the local authorities began to implement the following principle – not let working resources leave their district, to built new habitations in their districts. One of the good examples of such a mistake is the decision of the Mogilyov regional committee of the party and the regional executive committee to built the settlement Maysky in Cherikov district and to resettle there the inhabitants from settlements Chudyany and Malinovka of the same district. As a result the inhabitants of the new settlement raised agricultural products on their former individual plots (3 to 5 km from the new settlement Maysky) with contamination density over 40 to 80 Ci/km².

On June 22, 1986 INE submitted the map of Caesium-137 deposition on Mogilyov region to the Ministry for Public Health Services (MPHS), Ministry for Agricultural Production (MAP) and to the Mogilyov regional executive committee. As there was no reaction N.A. Borisevich, V.B. Nesterenko and the chairman of the Committee for Hydrometeorology submitted that map to the government and to the Central Committee of the Communist Party of Belarus making the proposal to MPHS to check the possibility of the safety living in 50 settlements of Mogilyov region. Concrete decisions were not accepted but in September our Institute was visited by the party committee in order to divert the staff of the Institute from the activities connected with the

Chernobyl subject and to “prove” the false application of the means for radiation protection of population.

In September 1986 by approbation of the authorities of the Academy of Sciences and the government of Belarus INE submitted the map of radiation deposition on southern regions of the Republic but it was not only Caesium-137 but also other radioisotopes deposition.

Local foodstuffs were transported from all southern regions of Belarus to the Institute for their radiation monitoring. At that time the measurements of radionuclide concentrations in foodstuffs were made at INE, the Institute of Physics of the Academy of Sciences and at the department for nuclear physics of the Byelorussian State University.

In summer 1986 under participation of the agrochemical services of the MAP of Belarus soil samples were taken in all southern regions of Belarus and in September-October the maps of radiation deposition on agricultural holdings of southern regions of Belarus (of districts and farms) was built.

The population of Belarus which lived in the areas contaminated by Caesium-137 over 37 kBq/m² consisted of 2105.2 thousand persons (including over 500 thousand children).

To a greater degree a quarter of the territory and one fifth of the population of the republic were affected.

Nowadays the Chernobyl regions of Belarus are characterised by the distorted demographic structure. During all those years 135 thousand people were resettled, not less than 200 thousand persons became forced refugees left the contaminated district on their own. Youth, intellectuals, skilled specialists and officials left, first of all. In some affected districts the part of pensioners is about 70% of the population.

The radioactive contamination of the territory caused serious problems in agriculture, first of all radiation contamination of agricultural production and local foodstuffs produced on those lands. About 20% (1.6 million hectares) of all agricultural holdings were exposed to ¹³⁷Cs-contamination over 1 Ci/km² kBq, basically in traditional agricultural districts. In 1986 to 1990 257.1 thousand hectares of agricultural holdings were excluded of the agricultural circulation.

The main reason of errors in Belarus made when implementing the activities on contaminated territories and of the fact that effective protective activities were not implemented for the population was the fact that all protective activities were guided by the Joint Government from Moscow and the Byelorussian authorities acted according to the orders of the Governmental Commission on Chernobyl located in Moscow. The Moscow bureaucracy worked up such a conception of safety living in contaminated regions to show the whole world that the dimensions of the damage to Belarus were not significant.

Here there are some examples. On June 13, 1986 L.N. Kuznetsov, the chairman of the State committee for agricultural production (Gosagroprom) of the USSR in coordination with P.N. Burgasov, the Chief state physician of the USSR, accepted “Temporary Recommendations for Conduction of the Agricultural Production in the Byelorussian SSR on Radiocontaminated Territories”. They permitted to produce agricultural products even on the lands of the 3rd zone where dose rate was from 5 microroentgen to 20 microroentgen an hour; to produce radiocontaminated agricultural products and to distribute them over the whole Republic. The local population lived in that area during the whole year accumulating intensively radionuclides because of the use for food local radiocontaminated foodstuffs.

“Recommendations for the Use of Meat Containing Radioactive Substances $2.0 \cdot 10^{-7}$ to $1.0 \cdot 10^{-6}$ Ci/kg for Production of Cooked Meats for 1986” accepted by the same L.N. Kuznetsov and coordinated with A.I. Zaichenko, the deputy Chief state physician, were so cruel and cynical.

Permissible Caesium-137 concentration levels in sausages made from contaminated meat were achieved due to the addition of radioactive meat, containing Caesium-137 concentration of 18000 to 37000 Bq/kg when mixing clean meat.

On June 24, 1986 the same men accepted the “Temporary Recommendations for the Primary Processing of Wool Received from Radiocontaminated Animals Went to the Factories of the Primary Processing of Wool”. In Belarus in Zhuravichi of Gomel region there was the only factory for the primary processing of wool in the whole republic. That is why after processing “clean” and “contaminated” wool at that enterprise all wool became radioactive finally. Then it was used for sewing clothes which enlarged external dose of people.

On July 23, 1986 G.A. Romanenko, the deputy Chairman of Gosagroprom of the USSR in coordination with A.I. Zaichenko, the deputy Chief state physician, accepted the “Temporary Recommendations for Procedure of Purchase, Acceptance, Storage and Use of Grains and Grassy Meal of the Crop 1986 Gathered on the Territory of the RSFSR, the Ukrainian SSR and Byelorussian SSR Exposed to Radiation Contamination”. It was recommended not to stop the grain production, to feed cattle with radioactive grains, to make alcohol from them. Hence came Caesium-137 contamination of milk and meat, and finally – people.

On the basis of those recommendations Gosagroprom of the BSSR in association with Ministry for Grain Production of the BSSR repeated those orders in their order No. 3c/21 C dated June 27, 1987. In order to carry out the order about 1 million tonnes of radioactive grains were processed and fed at poultry-farms and hog-breeding farms. At the same time two Ministries approved the list of 17 districts of Gomel and Mogilyov regions. Grain in them should have been exposed to the continuous dosimetric control but possible Caesium-137 concentration levels in grain were 3700 to 370 Bq/kg.

On July 01, 1987, according to the order of the government of the USSR and basing on the conclusion of MPHS of the USSR that it is possible to set the dose limit of about 50 rem during 70 years (during first 10 years – 25 years) and to distribute the annual doses as 3; 3; 2.5; 2; 2; 1.5; 1.5; 1; 1; 1 and then 0.5 rem each year up to the 70th year after the accident for the population living on contaminated territories in the report on radiation situation in Mogilyov, Gomel, Bryansk and Kiev regions the Committee for Hydrometeorology of the USSR, MPHS of the USSR, the Council of Ministers of Belarus, the Ukraine and Russia concluded the following – for the population it is possible to live in districts with the territorial contamination over 40 Ci/km² when using for food imported foodstuffs (first of all, milk) and implementing the following complexes of activities:

- ◆ “decontamination in settlements contaminated over 40 Ci/km²” (soil layer removal, making firm covers, changing thatches etc.) and the simultaneous ploughing up and sowing by perennial grass and crops from the fields surrounded these settlements (during 1987 the settlements contaminated over 60 Ci/km², the rest - in 1988);
- ◆ “implementation of the whole complex of special soil-conservation activities on all croplands in 1987 and on all pastures in the zone about 40 Ci/km² in 1987 and 1988. Separation of plots (in autumn 1987) for their urgent grassing for pastures for depasturing cows belonging to the population in settlements contaminated over 40 Ci/km² at the cost of croplands (with their exclusion out of land tenure)”;
- ◆ “completing the recommended soil-conservation activities in 1987 on the territories of private farms contaminated under 40 Ci/km² and implementation of the intensive soil-conservation activities (with application about 20 tonnes of zeolites per hectare and increased quantities of fertilisers) in settlements contaminated over 40 Ci/km²”;
- ◆ “implementation of the complex activities on such agricultural holdings contaminated about 80 Ci/km² will permit to decrease the contamination of agricultural; products in 1987 and

1988 already and in 3 to 4 years it is expected to decrease the pollution of all foodstuffs raised their up to the established norms and to call off the restrictions for the use of private agricultural products from private plots (during first 10 years)".

In March 1988 the chairman of Gosagroprom of the USSR V. Murakhovsky approved the "Guide for Conducting Agriculture in Conditions of Radioactive Contamination of the Part of the Territory of the RSFSR, the Ukrainian SSR and Byelorussian SSR for 1988 to 1990" submitted by the Inter-departmental commission of scientific experts in radiology in the agricultural complex, where there are peculiarities of the conduction of agriculture on radiocontaminated territories from 1.5 to 40 Ci/km².

This guide suggests to apply 1.5 time increased doses of phosphoric and potassium fertilisers on hayfields and pastures annually; recommends to continue cattle-breeding; it is recommended to apply 2 to 3 kg of double superphosphate and 3 to 4 kg of potassium chloride and sulphate per 100 m², lime materials and zeolite (200 kg per 100 m²) in order to reduce radionuclide entry in fruits, vegetables and potatoes in vegetable gardens and gardens.

For poultry the use for food of local fodder is not limited if they are fattened with the clean or slightly contaminated fodder 1 or 1.5 months before their slaughter; cattle-breeding and pig-breeding and their fattening is permitted without limitations but 1.5 or 2 months before their expected slaughter the cattle should be kept indoors and fattened with clean fodder.

As it is seen from the guide the specialists of the Union bodies require to carrying out the production on contaminated territories in all means in spite of the fact that the fattening with contaminated fodder causes the contamination of all kinds of products.

Having such recommendations, in 1987 to 1990 according to the order of the Gomel Agricultural Committee, the officials of enterprises sent people to the zone of resettling and there grass and grains were sowed to be used for feeding cattle.

In September 1989 the group of 92 scientists (incl. 5 Byelorussians) joined that improper play connected with the conception of safety living on radiocontaminated territories. They petitioned to M.S. Gorbachyov. In that petition they contended that the dose of 35 rem for the life, accepted by the National Committee for Radiation Protection (NCRP) of the USSR, was based on the long-term examination of the state of health of the population in Hiroshima and Nagasaki as well as in Chelyabinsk district of Russia affected by the accident at the storage of radioactive waste in 1957. In their petition the authors insisted that the resettlement of the inhabitants from the settlement should be made when the dose there could exceed 35 rem during the whole life when being in conditions of the normal living without any restrictions. That conception was approved by IAEA, WHO, NCARE and UN, according to the authors' words.

But it was already in 1989. The scientists both in Belarus and in the Ukraine were not agree with the conception of NCRP of the USSR – 35 rem during the life. The Academy of Sciences of Belarus accepted the new conception of the living on contaminated territories – 7 rem during the life.

MPHS of the USSR (A.Kondrusev) and NCRP of the USSR (L.A. Ilyin) organised the visit of representatives of the International Committee for Radiation Protection and WHO to Belarus. On June 24, 1989 at the meeting in the Academy of Sciences we were persuaded in acceptability of the concept – 35 rem during the life and the Dr. Pelleren declared during my report that we could accept 70 and 100 rem during the life because of the lack of financing for providing the population with clean foodstuffs and for its radiation protection.

The new concept of living on territories contaminated after the Chernobyl accident suggested that the permissible limit of 0.1 rem (1 mSv) a year should be accepted at their step-by-step

achievement: in 1991 – 0.5 rem (5 mSv)/a; in 1993 – 0.3 rem (3 mSv)/a; in 1995 – 0.2 rem (2 mSv)/a; in 1998 – 0.1 rem (1 mSv)/a.

The new zonation was accepted:

Zone of obligatory resettlement: Caesium-137 – 40 Ci/km², Stroncium-90 – 3 Ci/km², Plutonium – 0.1 Ci/km²,

Zone of resettlement: Caesium-137 – 15 to 40 Ci/km², Stroncium-90 – 2 to 3 Ci/km², Plutonium – 0.05-0.1 Ci/km², when the annual dose can exceed 5 mSv/a.

But now over 28 thousand persons live in this zone including 7000 children. In the Ukraine all people were resettled from the zone of 15 Ci/km².

Zone with the right for resettlement: Caesium-137 5 to 15 Ci/km², Stroncium-90 – 0.5 to 2 Ci/km², Plutonium – 0.01 to 0.05 Ci/km², when the permissible radiation limit for the population exceed 1 mSv/a.

Zone of living with periodical monitoring: Caesium-137 1 to 5 Ci/km², when the permissible radiation limit for the population must not exceed 1 mSv/a.

Organisation of radiation monitoring of agricultural holdings and foodstuffs

In summer 1986 the staff of INE and MAP (2 persons from each organisation) selected soil samples in all kinds of agricultural holdings (5 samples from every 100 hectares) and individual plots. The samples with the distinct selective coordinates were brought to INE where they were tested on the γ -spectrometer. By July 15, 1986 over 10 thousand samples were brought. According to the results of their tests the maps of Caesium-137 deposition on agricultural holdings in farm, districts and regions were made. Radiochemical measurements of the samples for Stroncium-90 concentration were conducted.

During all first months after the accident at the Chernobyl NPP the control of foodstuffs from contaminated zones was conducted at three Institutes.

By the middle of July 1986 mobile radiological laboratories were created at Gosagroprom and MPHS of Belarus. Radiometers for controlling foodstuffs were produced at the Institute for Nuclear Energetic, the Byelorussian State University and the Institute of Physics and distributed to the radiological services and Institutes of the Ministry for Agricultural Production of the republic. The mobile laboratories with specialists from MPHS and Gosagroprom visited all farms in Gomel and Mogilyov regions and stated that the bigger part of plants, fodder and products of animal husbandry were contaminated by Caesium-137 and Stroncium-90. Unfortunately, without knowing the actual size of the accident the authorities in the republican departments and in the regions ordered to process contaminated products everywhere basing on the Union recommendations. Therefore the radiation control services were organised at all 27 enterprises of meat industry, 127 dairy enterprises, 114 enterprises of food industry, 61 enterprises of the Ministry of Grain Production, 56 enterprises of fruit and vegetable industry and also in 1200 collective and state farms those territories had been contaminated by radionuclides. Apart from that 12 agricultural research institutes, 3 republican, 6 regional 117 local vet bacteriological laboratories, 188 stations for testing meat, 117 interregional laboratories, 6 regional stations for chemisation, 10 pedigree enterprises, 78 poultry-farms were used as places for the implementation of radiation monitoring. The whole radiation monitoring system counted 2122 places.

During all first months the equipping of those laboratories was made at the cost of the devices of the institutes in Minsk, the output of several hundreds of radiometers KRVP-3AB at the Lenin Minsk industrial works. It had produced them for equipping atomic submarines. According to our request the big lot of radiometric devices SRP-68-01 (about 4000) was delivered from Siberia from U-mines and atomic enterprises. Radiometers KRP-1, KRVP-3AB, RKP-4SM,

SRP-68-01, RUPP, RIS-1 were assembled and produced. For the complete equipping of all centres in the middle of June 1986 the following quantities were necessary: 502 radiometers DP-100, 639 – SRP-68-01 and approximately 300 KRVP devices. By the beginning of June there were only 121 DP-100 and 37 SRP-68-01. By January 01, 1987 there were 189 DP-100, 57 KRVP-3AB, 799 SRP-68-01.

By October 1986 we prepared 3077 specialists at the Byelorussian State University and the Academy of Sciences of the republic to work at centres for radiation control.

In August 1986 the system of radiation monitoring of foodstuffs at Minsk markets was approved.

In August 1987 the system of radiation monitoring of foodstuffs, agricultural products and objects of environment in Belarus was approved. Apart from agricultural products it controlled the contamination of mushrooms, wild berries and herbs.

All findings on radiation contamination levels of foodstuffs and maps were classified as secret. In spring 1989, at the 1st session of the Supreme Soviet of the USSR due to the initiative of the deputies from Belarus, the Ukraine and A.D. Sakharov it was decided to take all materials connected with the Chernobyl catastrophe off the secret list.

After taking all materials connected with Chernobyl off the secret list and actions of the state bodies for radiation protection of the population the inhabitants of Belarus (as well as in the Ukraine and in Russia) became to distrust the information about the size of the accident, the contamination degree of local foodstuffs and the health effects submitted by the state bodies.

Even at that time the main danger for the population came from the use for food of radiocontaminated foodstuffs. That danger of the constant radionuclide accumulation in the inhabitants of the Chernobyl regions, their internal exposure in small doses remains now later 17 years after the accident at the Chernobyl NPP.

The Byelorussian writer Ales Adamovich, A.D. Sakharov, the chairman of the Peace Foundation, chess player Anatoly Karpov suggested that I should organise the Institute for radiation protection of the population of Belarus. First of all, the population should have been informed about the actual radiation situation after the Chernobyl accident, about radionuclide contamination of foodstuffs, nature gifts and should have been trained to simple radiation protection measures for the inhabitants of Chernobyl regions.

The Institute of Radiation Safety “Belrad” (Institute “Belrad”) was established in 1990. The Institute “Belrad” suggested to the Supreme Soviet, the Byelorussian Government, the chairman of the regional executive committees to create the net of local centres for radiation control of foodstuffs of the population (LCRC). Those suggestions were included into the Law of the Republic of Belarus “About the Legal Regime of Territories Contaminated by Radiation as a Result of the Catastrophe at the Chernobyl NPP” with the following text in the article 40 “In settlements locating in zones of radioactive contamination the State committee of the Republic of Belarus for overcoming the consequences of the catastrophe at the Chernobyl NPP opens LCRC, when it is necessary, under the supervision of local authorities for the implementation of citizens’ requirements connected with the testing of foodstuffs and things of general use”.

The Institute “Belrad” developed a β - and γ -dosimeter “Sosna”. Its production was organised at the Institute and at the industrial works of Gomel, Borisov and Rechitsa (over 300 thousand devices were produced). At the same time the production of dosimeters RKSБ-104 was organised at Minsk industrial works.

Having developed and produced over 1000 gamma-radiometers RUG-92 the Institute “Belrad” promoted the equipping of radiological services of MAP, the Ministry of Forestry, the

Byelorussian Cooperation Union and LCRC with reliable devices with high sensitivity range for the monitoring of Caesium-137 concentrations in foodstuffs, water and environment.

In the southern part of Belarus the net of 370 LCRC was organised. The first 30 LCRC were open due to the financial support of the Peace Foundation of the USSR (A. Karpov) and the Byelorussian Peace Foundation (M. Yegorov). The Chernobyl Committee appointed the Institute "Belrad" the head organisation creating and maintaining LCRC and consulting the population. In such centres located at schools and at local administration buildings the population had a possibility to measure the radionuclide concentration in their foodstuffs and to get the objective information about the safety of the use them for food and about their culinary processing technique for radionuclide decontamination. The staff of the Institute "Belrad" in association with the local authorities selected the candidates of local teachers, doctors, nurses, agronomists. They were educated at our Institute and received the certificates. Every month the radiometrists send the reports containing the results of the radiation control of foodstuffs, nature gifts and fodder of the population. The Chernobyl Committee took its part paying for the production of devices for the LCRC and radiometrists' wages.

Nowadays the radiation monitoring data with the surnames of the owners of foodstuffs consists of over 350 thousand samples. According to these data the maps of the radiation contamination of milk, berries, mushrooms etc are made.

By now the number of LCRC supported by the Chernobyl Committee was reduced up to 40 because of the reduction of financing and other 20 LCRC in Belarus are operated due to the financial support of the German Chernobyl initiatives. Contamination density of milk is the paramount risk factor for the health of people, especially children. According to the data of LCRC of Gomel region and three districts of Brest region about 15% of milk controlled by LCRC had Caesium-137 contamination above the permissible level of 100 Bq/l.

As over 60% of the annual internal dose is received by children due to the use for food of local milk contaminated by Caesium-137, it is considered to be the best indicator for determination of the safety of living on contaminated territories. In 2001 the number of settlements having milk with Caesium-137 concentration exceeded permissible levels was 326. According to the data of MPHS milk was contaminated by Caesium-137 over 50 Bq/l (the permissible Caesium-137 concentration level for children's food must not exceed 37 Bq/kg, l) in more than 1,100 villages of Belarus.

Permissible levels of radionuclide contamination of foodstuffs and environment at the long-term radioactive contamination of the territory

Basing on emergency dose limits of 10 rem during the first year, 5 rem in 1987, 3 rem in 1988, 3 rem in 1989, 0.5 in 1990 (50% of external dose, 50% of internal dose), in 1986, 1988 and 1991 MPHS of the USSR approved temporary permissible levels for Caesium-137 radionuclide concentration in foodstuffs and drinking water. The table demonstrates temporary permissible levels (VDU-86, VDU-88, VDU-91), republican control levels (RKU-90) and RDU-99) for Caesium-137 concentration in foodstuffs and drinking water.

Table
 Temporary permissible levels (VDU-86, VDU-88, VDU-91),
 republican control levels (RKU-90) and republican permissible levels (RDU-92, RDU-96, RDU-99) for Caesium-137 concentration in foodstuffs and drinking water

Foodstuff	VDU-86	VDU-88	VDU-91	RKU-90	RDU-92	RDU-96	RDU-99
Drinking water	370	18.5	18.5	18.5	18.5	18.5	10
Milk and whole milk products	370	370	370	185	111	111	100
Concentrated milk	7400	1100	1100	370			200
Butter	7400	1100	370	370	185	185	100
Cottage cheese and curd products	3700	370	370	185			50
Meat and meat products							
beef	3700	2960	740	592	600	600	500
mutton	3700	1850	740	592	600	600	500
pork, poultry and their products	3700	1850	740	592	600	370	180
Vegetable fat	7400	370	185	185	185	185	40
Adipose, margarine	7400	370	185	185	185	185	100
Potatoes, table greens	3700	740	600	592	370	100	80
Bread and bakery	-	370	370	370	185	74	40
Flour, cereals, sugar	-	370	370	370	370	100	60
Vegetables and edible roots	3700	740	600	185	185	100	100
Fruits	3700	740	600	185	185	100	40
Garden berries	3700	740	600	185	185	100	70
Wild berries and preserved food made from them	-	-	1480	185	185	185	185
Tinned vegetables and fruits, juice, honey	-	740	600	185	185	185	185
Fresh mushrooms	-	-	1480	-	370	370	370
Dried mushrooms, dried fruits	-	11100	7400	3700	3700	3700	2500
Other foodstuffs and food additives	-	-	-	592	370	370	370
Herbs, tee	-	-	7400	1850			
Special products for children of all kinds, ready for use	-	1850	185	37			37

Considering the annual food allowance according VDU-88 internal dose was 0.7 to 0.8 rem/a. RKU-90 accepted by MPHS in August 1990 was calculated in such a way internal dose would be 0.17 rem/a at the possible radionuclide intake of radionuclides with foodstuffs. In Belarus current RKU-90 happened to more strict than those accepted at the beginning of 1991 by MPHS of the USSR new temporary permissible levels VDU-91.

Principles of the local radiation control consists in the obligatory thrice-repeated control: at place of its production, when processing it and, at last, when purchasing integrated products. During first three-four years radiation control centres were introduced to all collective farms and state farms and also to all works for keeping, processing and purchasing foodstuffs.

According to the MPHS data nowadays the portion of contaminated foodstuffs is not reduced but the radiation control system was diminished ten times.

During last years the dangerous Stroncium-90 contamination of grain, milk and vegetables was revealed at 28 Belarusian farms.

The Institute for Economics of the Academy of Sciences of Belarus defined the economical damage of the consequences of the Chernobyl catastrophe for Belarus during 30 years to be 235 milliard USA dollars that makes 32 annual national budgets of the republic. Though the state spent from 20% to 6% of the annual budget for the Chernobyl programs in different years that aids to the population of the affected regions were insufficient and did not guarantee the safety living on contaminated territories.

The level of income of the inhabitants of these regions is too small for them to buy clean foodstuffs. They have to use for food local foodstuffs with Caesium-137. More than 80 to 90% of the annual dose (Caesium-137) is received by the inhabitants because of the use for food of local foodstuffs.

The long-term small radiation doses effects influence negatively on the health of inhabitants of Belarus and children, first of all, who live in the Chernobyl regions of the republic.

State of health of the population [5]

As a result of the Chernobyl catastrophe the population of Belarus was exposed and is being exposed to the influence of negative factors, the basic of them was radiation. All people of the republic were irradiated by iodine radionuclides at the early period of the accident. About 10 thousand people had operations on thyroid cancer, including 1800 children.

Among the population living or lived on territories with Caesium-137 contamination density over 37 kBq/m² the scientifically significant increase of the sickness rate by malignant formations of respiration organs, digestion organs and by dairy gland cancer was admitted. In these regions genetic dysfunctions, congenital malformations first of all, were significant established.

As for bodily diseases of the affected population the scientifically significant increase of the sickness rate by cataract and ischemia, of the diseases of the respiration system, urino-genital system, endocrine system, immune system, of the stomach ulcer, duodenal ulcer and dysfunctions of metabolism was stated.

The special anxiety in the society is caused by the state of the health of children characterised by the increase of the sickness rate and the decrease of practically healthy children (from 85% to 20% in the republic and to 6% in Gomel region).

Principles of radiation protection of the population of Belarus

In Belarus the following Laws were accepted:

- ◆ Law of the Republic of Belarus “About the Social Defence of Citizens Affected by the Accident at the Chernobyl NPP”, 1991;
- ◆ Law of the Republic of Belarus “About the Legal Regime of Territories Contaminated by Radiation as a Result of the Catastrophe at the Chernobyl NPP”, 1991;
- ◆ Law “About Radiation Safety of the Population of Belarus”, 1998.

These Laws defined the average annual effective radiation exposure of the population of 1 mSv/a. It is written in the addition and the modification of the Law of the Republic of Belarus

“About the Social Defence of Citizens Affected by the Accident at the Chernobyl NPP” No 31-1 dated May 17, 2001:

“As a index of the assessment of the territory where the live conditions and working conditions of the population do not require any restrictions the average annual effective radiation exposure is set that must not exceed 1 mSv above the natural and man-caused radiation background.

If the average effective radiation exposure of the population exceeds 1 mSv/a radiation protection activities take place.

When the average effective radiation exposure of the population is reduced from 1 to 0.1 mSv/a the protective activities are not cancelled, their scope and character is regulated by the Council of Ministers of the Republic of Belarus.

When the average effective radiation exposure of the population is under 0.1 mSv/a above the natural and man-caused radiation background the protective activities do not take place and the territory and the population living there is considered to be taken out of the condition of the emergency radiation effects.”

It is known that for the dose limit of 1 mSv/a the Chief sanitary inspector of MPHS of the Republic of Belarus approved the dose limits of the Caesium-137 and Strontium-90

Radionuclides concentrations in foodstuffs and drinking water (RDU-99) basing on the annual actual food allowance of the inhabitants of the Chernobyl regions. Unfortunately MPHS did not accepted the permissible Caesium-137 concentration levels in basic dose forming foodstuffs corresponding to the dose limit of 0.1 mSv/a. The dose limits are calculated values and can not be measured and unknown for the population. The set permissible levels of radionuclides concentrations in foodstuffs, equivalent to 0.1 mSv/a, would be a definite guiding line for the population for the lower limit of the safety contamination of foodstuffs.

In Russia (in 1999) and then in Belarus in 2000 the following basic National documents in the field of radiation safety and protection of the population were accepted:

- ◆ Norms of radiation safety and protection of the population,
- ◆ Basic sanitary rules for radiation prevention.

In Belarus the activities on overcoming the consequences of the accident at the Chernobyl NPP are implemented in frameworks of the special state programs financed from the budget. The first program (1990 to 1992) was financed in conditions of the USSR. From 1993 to 1995 and from 1996 to 2000 the republican state programs were implemented. Nowadays the State programs for overcoming of the catastrophe at the Chernobyl NPP for the period 2001-2001 and the up to 2010 are in use.

Apart from the medical assistance for the population the important parts of the program is the implementation of protective activities on the most contaminated territories; the receipt of exhaustive objective information about the radioactive contamination of the environmental objects and the radiation effects limits for the population for the substantiation and adjustment of the decisions, the guaranteeing of the agricultural production with the radionuclide concentrations which do not exceed the permissible levels and the decrease of radiation effects for the health of people.

In its time the spectrometers of human radiation (WBC) were placed in all municipal, regional and republican hospitals, The Belarusian government accepted the resolution obliged all heads of enterprises, ministers and departments to make WBC-measurements of all inhabitants of the Chernobyl regions of Belarus. Unfortunately the existing WBC, a low quality of their services resulted in the annual certification of less than one third of WBC in services of the State committee on standards. In Slavgorod district WBC has not been operated for 3 years, in Bragin district for 2 years.

The WBC-measurements of the Caesium-137 accumulation in the inhabitants of these regions characterise the efficiency of the radiation protection activities for the population. The absence of the system of the practical WBC-monitoring of the Caesium-137 accumulation levels in the children of the Chernobyl regions and of the testing of the efficiency of the implemented radiation protection activities with their help is especially pernicious.

Since 1995 the Institute “Belrad” has begun to create the net of mobile WBC-laboratories for the radiation monitoring of the Caesium-137 accumulation levels in 500 thousand children of the Chernobyl regions of Belarus. Now there are 8 mobile radiological WBC-laboratories of 15 necessary.

Since 1996 the Institute “Belrad” has measured children on WBC to determine their Caesium-137 accumulation. From 1996 to 2003 190 thousand children were measured on WBC. Those measurements demonstrated that only 10 to 15% of children had the internal Caesium-137 accumulation under 10 to 15 Bq/kg. The maximal Caesium-137 concentration levels in children reach 4000 to 7200 Bq/kg. The medical investigations made by the professor, Doctor of Medicine Ye.B. Burlakova, the academician of the Russian Academy of Sciences A.V. Yablokov (Russia), by the professor Yu.I. Bandazhevsky and professor T.A. Birich (Belarus) demonstrated that pathological dysfunctions of important organs and systems of children can appear at the Caesium-137 accumulation level in the organism of 30 to 50 Bq/kg. Heart muscle is especially sensitive to the radiation contamination of the organism.

Therefore the important objective of this activity of the Institute “Belrad” consists in the radiation monitoring of the children of the Chernobyl regions of Belarus (21 district) and in making maps of the radiation contamination of children. In these regions 190 thousand children were measured on WBC in villages of Gomel, Brest, Mogilyov, Minsk, Grodno and Vitebsk regions. The most irradiating critical groups of population were single out in the data bank of these villages. This program is implemented in association with the Research Centre Juelich (Germany) when being financed by the Ministry for Preservation of the Environment and Radiation Safety of Germany.

In 1992 the Ministry for Public Health Services of the Republic of Belarus published the Catalogue of dose burdens of the population for 3668 settlements of the republic. Unfortunately, when making the Catalogue of dose burdens of MPHS made the principle mistake determining the annual dose burdens in each settlement basing on radioactivity of 10 milk samples and 10 potato samples that resulted in the inauthenticity of the excerpts and to the depreciation of annual dose burdens in the whole.

The inadmissible mixing of the purposes of the epidemiological medical research and the prior purposes of the radiation protection of the population. When in the first case it is necessary to determine the average annual dose burden value (collective dose) in order to determine the expected number of patients, in principles of the radiation protection it is important to single out the critical group (10 the most irradiated persons) and to guarantee such protective measures for the annual dose burdens in the critical group not to exceed 0.3 mSv/a (according to Radiation Safety Norms). In the field of radiation protection there is a principle of the critical group when the protection based on the most vulnerable groups (children, pregnant, old people) and the weakest persons are protected.

In 1998, 2000, 2002 MPHS made attempts to accept the new Catalogue of dose burdens of the population of Belarus. The Chernobyl Committee and the House of Representatives of the National Assembly of Belarus organised the commission of experts that carried out the direct WBC-measurements of 5000 inhabitants (basically children) in 45 villages. Those measurements showed that he calculated doses values (for 10 milk and 10 potatoes samples) of the new Catalogue were underestimated 6 to 8 times in comparison with dose burdens. Those results

were reported first at the inter-departmental commission and then at the Parliamentary Assembly, the claims were considered as ungrounded and MPHS was forced to take aside the new Catalogue of dose burdens as inauthentic.

Unfortunately, in summer 2002 MPHS and the National Commission for Radiation Protection (NCRP) introduced new motions to the government of the republic and on August 8, 2002 the Council of Ministers of Belarus approved the new zonation of territories according the radiation contamination level and 146 villages were excluded from the list of the objects which are situated on the contaminated territories. They were considered to be clean. As a result the children from those villages deprived of clean meals at school canteens and of the annual rehabilitation at sanatoria in clean regions of the republic due to the financing from the State Chernobyl program.

It is very important to develop the system of informing and education of the population promoting the learning of the scientific and medical recommendations in the field of safety living. It is necessary to study not only the sickness rate of the population in the Chernobyl regions but to implement the necessary radiation protection activities and the treatment of the suffered population.

Here some activities for minimisation of the internal exposure of the population can be listed:

- ◆ Resettlement (135 thousand persons were resettled);
- ◆ Cultivation of pastures and hayfields, agrochemical protective activities in agriculture (about 0.5 hectares of pastures and hayfields per a cow were cultivated once during 17 years and it is necessary to do it each 3 or 4 years);
- ◆ Mixed fodder with sorbents and boles in cattle-breeding (the production of mixed fodder with sorbents (Berlin blue), calculating 50 kg per one cow, was organised at 5 works, is necessary 200 to 250 kg per one cow);
- ◆ Meals for children at schools and kindergartens due to the Chernobyl program, annual rehabilitation in clean districts and abroad;
- ◆ Organisation of the production of food additives and their inclusion in the food allowance for decontamination of the organism from radionuclides and heavy metals.

The Institute "Belrad" used the scientific innovations of the Centre for Radiation Medicine of the Ukraine and the recommendations of the Institute for Radiation Medicine of MPHS of Belarus (Candidate of medical sciences N.A. Gres) advised to include the 21-days cycles of the intake of pectin food additives with vitamins and microelements into the food allowance of children in the Chernobyl regions 4 times a year.

Since 1996 the Institute "Belrad" has used the French pectin additive "Medetopect" at first, then the Ukrainian pectin preparation "Yablopect" in order to decontaminate the organisms of children from radionuclides. In association with the German pharmacist, Dr. Juergen (Munich) the Institute "Belrad" developed the mixture of the pectin apple drink "Vitapect" enriched by 7 vitamins (group B, C, E, β -carotene) and 4 microelements (K, Zn, Se, Ca) "Vitapect" and in April 2000 got a Certificate of MPHS of the Republic of Belarus for the production, purchase and application of this preparation.

According to the task of Chernobyl Committee of Belarus the comparative tests of the efficiency of pectin and vitamin preparations "Medetopect" (France), "Vitapect" (Institute "Belrad"), Spirulina (Russia) and the vitamin preparation "Vitus-Iod" was carried out at the sanatorium "Belarus". The groups of children (up to 30 persons in each group) took these preparations two times a day during 21 days. The WBC-measurements made before and after the intake of these preparations demonstrated the decrease of the Caesium-137 concentration in the children:

- ◆ 46 to 49% decrease when taking pectins;
- ◆ 31 to 35% decrease when taking Spirulina;
- ◆ 23% decrease when taking “Vitus-Iod”;
- ◆ 18% decrease in the control group (without taking these preparations).

The tests of the efficiency of the intake of the pectin preparation “Vitapect” and the preparation “Placebo” implemented at the sanatorium “Serebryanye Klyuchi” under the European standards (double blind tests) demonstrated that during 21 days there was the 13.9% decrease of the Caesium-137 concentration in children when taking “Placebo” and 65% decrease when taking “Vitapect”.

Participation of the non-governmental Institute of Radiation Safety “Belrad” in overcoming the consequences of the Chernobyl accident in Belarus

During the first years of the activity of the Institute “Belrad”, when the Supreme Soviet of the USSR and BSSR made a decision to remove from the secret list all the materials on the Chernobyl accident, the inhabitants of Belarus began to distrust the information of the governmental structures about the levels of the contamination of the territory and foodstuffs.

Since 1989 the government of Belarus began to get the stuff of the non-governmental Institute of Radiation Safety “Belrad” (from 1989 to 1990 it was called the Scientific and Technical Centre for Radiation Safety “Radiometer”) to take part at commissions for the assessment of the radiation situation and ruling of radiation protection measures of the population. It was in 1989 and 1990 when the complex commission of the Council of Ministries of Belarus (the chairman – professor V.B. Nesterenko) consisting of the specialists in radiation protection, agricultural radiology, forestry, medicine and sociology made complex investigations of the villages Chudyuny ($> 147 \text{ Ci/km}^2$), Malinovka, Maysky of Cherikov district of Mogilyov region. The proposals of the Commission were accepted by the government and the inhabitants of those villages were resettled. Six months later the same commission made the complex investigation of the village Veprin of Cherikov district. According to the results of the work of the commission all children were taken out to the sanatoria of Russia for several months for rehabilitation, then all inhabitants of the village were resettled, the total activity was terminated and the village was land-buried (there the streets with the Caesium-137 contamination density over 55 Ci/km^2 and with the -137 contamination density over 55 Ci/km^2 were revealed).

In 1990 and 1991 the same commission investigated the living conditions and the possibilities of production of foodstuffs containing Caesium-137 in limits of the RDU-90 (republican permissible levels) in some villages of Narovlya district after strikes of the workers of Narovlya because of these causes. According to the results of the work of the commission 65 villages were revealed in which dose burdens could exceed 35 rem for the life. The government made a decision of the additional resettlement of 8 villages of Narovlya district and the part of inhabitants with the children of the settlement Narovlya.

In autumn 1991 such commission on behalf of the government of Belarus made the complex investigations of the villages Olmany, Gorodnaya and other villages of Stolin district. The commission worked with local authorities, schools and the whole population. In all villages the LCRC for informing the population were organized and additional radiation protection measures of children (clean foodstuffs at schools, double rehabilitation in sanatoria of clean regions of Belarus during a year etc.) were accepted.

As a result of that work the net of 20 LCRC was organized in Stolin district, 5 of them were used when implementing the project ETOS.

The next fundamental stage of informing the population consisted in developing the program of the WBC-radiation monitoring of the Caesium-137 accumulation levels in children by the Institute “Belrad” and in searching for the ways of their minimization.

Since 1995 the Institute “Belrad” began to organize the measuring basis as a kind of mobile WBC-laboratories for the determination of the Caesium-137 accumulation levels in children. Due to the help of the Chernobyl initiatives from Germany, Ireland, Norway, the USA and of the World Church Council 8 mobile laboratories were developed of the base of minibuses Ford, Mercedes, Volkswagen which had been presented to the Institute “Belrad” by the Irish Chernobyl Children Project and the Vienna city council.

To the end of the year 2003 over 200 thousand of WBC-measurements of children were performed at schools and kindergartens of the Chernobyl regions of Belarus. High Caesium-137 accumulation levels in children were revealed, their maximal value reached 4000 to 7000 Bq/kg of body weight (BW) of a child.

That information was submitted to parents, school and regional administrations. The results of WBC-measurements were integrated and published by approbation of parents and children in the Information lists, which were submitted to the Government, President’s Administration, Ministry for Public Health Services (MPHS), all governors, executive committees and all LCRC to inform them and to accept protective measures.

On behalf of the Ministry for Emergency Situations (MES) and the Commission of the Chamber of Representatives for the problems of the Chernobyl accident the Institute “Belrad” was involved, as expert, in investigations of actual Caesium-137 accumulation levels in inhabitants of 45 villages declared by MPHS as safety. Those WBC-measurements demonstrated that actual annual burden doses of the inhabitants of those villages were 6 to 8 times higher than those in the Dose Catalogue submitted by MPHS to the Government of Belarus. In April 2000 the results of the work of Commission were reported at the special session of the Chamber of Representatives for the problems of the consequences of the Chernobyl accident. The proposals of the commission (the chairman V.B. Nesterenko) were accepted, MPHS was obliged to recall the draft of the Catalogue of Annual doses of the population of Belarus (2000) from the Government and to send it to the Institute for Radiation Medicine and Endocrinology for revision.

Just a day later the medical commission came to the Institute “Belrad” with the directions of MPHS of Belarus (Minister I.B. Zelenkevich) about the prohibition for the Institute “Belrad” to perform WBC-measurements of inhabitants because that procedure reported to be medical one and the Institute should have got a medical license from MPHS. With a special letter MPHS sent its directions to all public health structures ordering to abrogate the contracts with the Institute “Belrad” since it had not got the medical license.

The Institute “Belrad” had a license of MES of Belarus for the performance of the radiation control in the environment and foodstuffs. The decision of the Minister for Public Health Services was appealed in the letter to the President of the Republic of Belarus. On behalf of the Administration of the President MES made the international examination of the project of the Institute “Belrad” “Radiation WBC Monitoring of Radionuclide Accumulation in Children and Their Protection with Pectin Preparations”. The international experts from Russia, the Ukraine, Belarus and France confirmed WBC measurements to be a physical procedure and the Ministry of Justice of Belarus confirmed that the Institute Belrad, having the license for radiation measurements, did not need the medical license.

The Institute used the scientific innovations of the Centre for Radiation Medicine of the Ukraine and the recommendations of the Institute for Radiation Medicine of MPHS of Belarus (Candidate of medical sciences N.A. Gres) advised to include the 21-days cycles of the intake of pectin food additives with vitamins and microelements into the food allowance of children in the Chernobyl regions 4 times a year.

In 1996 the Institute “Belrad” started the implementation of the program in association with the Chernobyl initiatives from Germany, England, France, Italy, the USA, Austria, Ireland, Belgium and Switzerland on WBC measurements of the Caesium-137 radionuclide accumulation

in children and the 2 – 4 times intake a year of pectin food additives for the decontamination of the organism of children from radionuclides. First the French preparation “Medetopect” was used, then the Ukrainian “Yablopect”. In 2000 the Institute “Belrad” got the license of MPHS of Belarus permitting to produce and to use the food additive “Vitapect”. There are the results of international double blind investigations at the sanatorium “Silver Springs” concerning the efficiency of the removal of radionuclides from the organism of children when taking the preparation “Vitapect” (65%) in comparison with the control group when taking the “Placebo” (13.9%).

The sizes of the accident and the economic damage for the Belarusian economy from the Chernobyl accident (235 milliards US dollars) are too large that for one country it is impossible to provide the population of the Chernobyl regions (2.5 million persons, including 500 thousand children) of the whole republic with clean foodstuffs and another important radiation protection measures.

The data basis of the WBC measurements of Caesium-137 accumulation levels in children of the Chernobyl regions, MPHS and the Institute “Belrad” (maps on radiation contamination of children from 12 districts) have, permit to organize the addressed radiation protection of children in these regions. The protective measures should be ensured in such a way for the annual dose burden in the critical group not to exceed 0.3 mSv/a and in the whole settlement to be under 0.1mSv/a, as it is foreseen in the addendum and the modification of the Law of the Republic of Belarus “About the Social Protection of Citizens, affected by the Accident at the Chernobyl NPP” # 31-1 dated to May 17, 2001. Having the provided scale of financing of the Chernobyl program such an approach could permit to define the critical, the most irradiated group of children from families, having many children, and of arm families in each village and to keep the food allowance at schools and the annual rehabilitation due to the means of the State Chernobyl program for them.

In August 2002 according to the submission of MPHS of the Republic of Belarus the Decree of the Council of Ministers of the Republic of Belarus No 1076 dated to 08.08.2002 excluded 146 villages of the Chernobyl regions of the republic from the list of the settlements located in the zone of radiation contamination. As a result of that decision 66 thousand inhabitants (including 17 thousand children) were deprived of the state aid for providing their radiation protection. The same Decree decreased the radiation status for 71 villages more (60 thousand inhabitants including 13 thousand children) that would cause the decrease of the scale of financing of the radiation protection of the population.

In 2002 and 2003 together with the association “Enfants de Tchernobyl Belarus” (France, Solange Fernex) the Institute “Belrad” could implement the project “Forgotten villages” and performed WBC-measurements of the group of inhabitants in 20 villages (scientifically significant sampling). Those measurements demonstrated that in all 20 villages and in the town of Kalinkovichi (38 thousand persons) internal exposure doses exceeded 0.3 to 0.4 mSv/a as well as in 17 settlements those radiation status was decreased (including the settlement Korma with 4900 inhabitants with dose burdens in the critical group of 1.6 to 1.8 mSv/a, the town of Dobrush with 20100 inhabitants with dose burdens in the critical group of 0.3 mSv/a).

Therefore the Article 3 of the Law of the Republic of Belarus No 31-3 dated to 04.06.2001 “About the Social Protection of Citizens, affected by the Accident at the Chernobyl NPP” is not implemented.

Everything testifies to the fact that the mistake was made when determining the list of settlements excluded from the State list of settlements and objects located in the zone of radiation contamination and when terminating the radiation protection of the population at the expense of the means of the Chernobyl program.

The whole information on the results of WBC-measurements was sent to the local authorities for making decisions.

In the same Decree of the Council of Ministers of the Republic of Belarus MPHS was ordered to prepare the Catalogue of dose burdens of the population of Belarus. The Republican Scientific and Practical Centre for Radiation Medicine and Human Ecology (RSPC RM&HE) in Gomel prepared the new Methods of calculation of the annual doses of the populations which are based on the hypothesis of proportionality between the annual dose burden of inhabitants of the Chernobyl regions and the contamination density of the territory. The members of the Institute "Belrad" (Professor V.B. Nesterenko and Professor A.N. Devoyno) were included in the commission of experts of the National Commission for Radiation Protection for the assessment of the scientific significance of the "Methods of Determining of Annual Dose Burdens of the Population of Belarus" proposed by RSPC RM&HE (Gomel). The Institute "Belrad" submitted to the committee of experts the results of WBC-measurements processing for 97 villages of Gomel region, 9 villages of Mogilyov region and 18 villages of Brest region. The coefficient **K** value (relation of the average specific radionuclide accumulation in inhabitants to the contamination density of the territory) varies from 0 to 354 in Gomel region, from 7 to 95 in Mogilyov region and from 6 to 85 in Brest region.

So the main hypothesis of the authors of the "Methods of Determining of Annual Dose Burdens of the Population of Belarus" based of the radiation contamination density of soil has no scientific ground. Therefore the National Committee for Radiation Protection rejected it.

The new Catalogue of dose burdens of the population should be developed on the basis of the existing in the Belgidromet direct measurements of the dose rate in each settlement (external exposure dose) and the internal exposure dose of the inhabitants of each settlement should be determined according to the dose burden for the critical, the most irradiated group of inhabitants (10 to 15 persons). It is received through the direct WBC-measurements of the representative group of inhabitants.

At the Gomel RSPC RM&HE the lack of the data of the direct WBC-measurements of the radionuclide accumulation in inhabitants of several villages of Gomel region and especially in Brest and Mogilyov regions were revealed. The Institute „Belrad“ proposed the administration of RSPC RM&HE to use our mobile WBC for the receipt of the missing information (not less than two times a year in each settlement). Our proposal has not been accepted yet.

The measuring abilities of the mobile WBC-laboratories of the Institute „Belrad“ permit to perform measurements of 55 to 60 thousand persons a year and to ensure the reliable data of the radionuclide accumulation level in inhabitants of the villages mostly contaminated by Caesium-137.

The direct WBC-measurements will permit to reveal the most irradiated groups of the population in the Chernobyl regions of Belarus and to form the addressed radiation protection of the population of the republic.

Conclusion

1. For the more effective radiation protection of the population (within a radius of 300 to 500 km from the NPP) it is necessary for the family to have the constant update reserve of iodine preparations and to carry out the iodine preventive measures during the first hours after the accident.
2. In countries having their NPP and in contiguous countries the system of the monitoring of the environment and foodstuffs should be organised beforehand.
3. Around the NPP (about 100 km) the systems of automatic monitoring of the radiation state and the direct informing of the population about the emergent danger and recommendations on radiation protection activities should be created.
4. Beforehand, in all European countries:

- ◆ the state systems for radiation control of foodstuffs and the local centres of radiation control of foodstuffs must be organised;
- ◆ the net of mobile and fixed radiological laboratories with WBC should be created for the examination of the significant excerption of different social groups of the population in order to determine the Caesium-137 accumulation levels in inhabitants (especially in children);
- ◆ there would be the reserves of the production of food additives for the decontamination of the organism from radionuclides,
- ◆ there would be the developed guide for carrying on agroindustrial business in order to get clean agricultural products in conditions of the moderate radioactive contamination of soil;
- ◆ the dynamic system of permissible levels of contamination of foodstuffs and agricultural products, as for example in Austria in 1986 to 1988.

Experts:

Professor	V.N. Nesterenko
Expert-Ecologist	A.V. Nesterenko

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