

# COMPARISON OF THE EFFICIENCY OF THE RECUPERATION OF CHILDREN OF THE CHERNOBYL DISTRICTS OF BELARUS IN THE NATIONAL SANATORIA AND ABROAD

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## INTRODUCTION

In Chernobyl regions of Belarus there live 1.5 million persons including about 400 000 children.

After removing from secret list the materials about the consequences of the Chernobyl accident the recuperation of children from these regions became widespread in Germany, France, Italy, Spain, England, Ireland, Austria, Canada etc. During the last years 50 to 60 thousand children were recuperated abroad.

In Belarus the recuperation inside the country is also welcome. For this purpose military stations in the republic, left after removing missile plants from the territory of Belarus, were reequipped into children recuperation centres. The majority of such centres are a part of the structure of the Department for the liquidation of the consequences of the Chernobyl accident of the Ministry for Emergency Situations (MES). Especially the National children recuperation centre "Zhdanovichi" is worth mentioning. It was established instead of the tourist centre of the Ministry of Defense.

According to the proposal made by the Chernobyl initiative of Germany, Ireland and France the Institute "Belrad" got the license of the Department for humanitarian activities at the President of the Republic of Belarus for recuperation of children abroad and sends the groups of children to Austria, Germany, Spain, France, Japan and another countries for recuperation every year.

The presence of modern spectrometers for human radiation (WBC) permit to determine the efficiency of recuperation and different methods of decreasing radionuclides contents in their organism by performing the measurements of  $^{137}\text{Caesium}$  radionuclides contents in children before and after the recuperation period, in particular this is an application of pectin preparations, namely the dried apple vitamin drink "Vitapect".

## THE EFFICIENCY OF THE RECUPERATION OF CHILDREN FROM THE CHERNOBYL REGIONS OF BELARUS ABROAD IN COMBINATION WITH THEIR RADIATION PROTECTION BY PECTINS

At request of the Association "International Movement "Associates" (IMA) the Institute BELRAD performed WBC measurements of the group of children (16 persons) in the beginning and after their recuperation in the sanatorium "Lasurny" (not far from Minsk). The average reduction of specific activity in children in this group reached 20%. The results of the work are described in the express-report of the IRS "Belrad" about the recuperation of children performed by the international public association IMA (V.I. Babenko, I.V. Krasnopyorov, 2007).

In previous years the same Association IMA sent the groups of children for recuperation in Italy controlling  $^{137}\text{Caesium}$  contents in children before the departure and after the return home. The decrease of  $^{137}\text{Caesium}$  contents in children reached to 15 to 20%.

Starting from 1995 the clinical tests of pectin preparations as enterosorbents for the elimination of radionuclides and heavy metals from the organism were performed in the Ukraine (N.G. Karnaukh, 1997), Russia (Methodical recommendations for using pectins "Zosterin-Ultra", 2003) and Belarus (N.A. Gres and co-authors, 1997).

As it became known later, from 1980 to 1981 the Expert Committee for food additives of WHO and FAO of the UN had performed two years clinical tests of pectins and had mentioned

in the final report (publication No.16, 1981) that pectins had no side effects, were not toxic and could be used every day.

That permitted the Institute BELRAD, the Association “Children of Chernobyl in Belarus” (France) and the physicians of the sanatorium “Serebryanye Kluchi” to elaborate the protocol, to get parents’ and children’ consent and to perform controlled tests in June 2001 under international standards (double blind method) to compare the efficiency of the set of the dried apple pectin vitamin drink “Vitapect” and Placebo (fruit kissel). There took place the WBC measurement of the level of radionuclide specific activity in children living in the Chernobyl zone of Belarus and staying in the sanatorium “Serebryanye Kluchi” (Svetlogorsk district, Gomel region). According to the results of those measurements two groups of children of 32 persons in each group (A and B) were chosen. The children from the group A received “Vitapect” (the dried apple pectin drink “Vitapect” enriched with vitamins B<sub>2</sub>, B<sub>6</sub>, B<sub>12</sub>, C, E, β-carotene, folic acid and trace elements K, Zn, Se). The children from the group B received “Placebo” (based on fruit kissel). The children were measured before and after taking the preparations (anonymously, without knowing who took this or that preparation). The statistical processing of the results of the primary and repeated WBC measurements gave following results: the reduction of <sup>137</sup>Caesium contents in children taken “Vitapect” reached to 65.6% and in children taken Placebo – to 13.9% (figure 1). The statistical difference is scientifically significant, (p<0,01).

At the same time the staff of the Institute BELRAD tested basic foodstuffs at the canteen of the sanatorium “Serebryanye Kluchi” on the radiometer RUG-92 and determined that all the foodstuffs had <sup>137</sup>Caesium contents under RDU-99 permissible levels that could not be a reason of the increase of <sup>137</sup>Caesium contents during the recuperation period in the sanatorium. The mentioned results are given in the Information list of the IRS “Belrad” (V.B. Nesterenko, 2005).

In 2001 and 2002 in response to the proposals of the Institute BELRAD to include the intake of pectin drinks in the food allowance of in schools and kindergartens the Ministry for Public Health Services of the Republic of Belarus expressed its anxiety that the intake of pectin preparations can eliminate vitally important trace elements together with radionuclides. In our reports we mentioned that all this had been already tested when performing clinical investigations in Russia, the Ukraine and Belarus, that pectins promoted the elimination of heavy metals and radionuclides and did not upset the balance of vitally important trace elements. In the methodical recommendations of the Ministry for Public Health Services of the Republic of Belarus (2000) it was also mentioned the intake of pectin preparations 2 to 3 times a year with a daily dose of 6-8 g did not show any side effects. We also gave the arguments about the clinical tests of pectins under the WHO UN program in 1980 and 1981 and the data of the Expert Committee food additives of WHO and FAO of the UN that pectins were not toxic and had no side effects and that they could be taken every day.

But the Ministry for Public Health Services of the Republic of Belarus insisted on the repletion of the efficiency of the application of the pectin drink “Vitapect” in Belarus. Therefore from 2003 to 2004 in framework of the joint program performed by the Nuclear Research Centre “Juelich” (Germany) and the Institute BELRAD there was studied the efficiency of the elimination of radionuclides when taking the pectin preparation “Vitapect” with the WBC control of <sup>137</sup>Caesium contents in children staying at sanatoria “Serebryanye Klyuchi” and “Lesnye Dali” before and after its intake (duration of the intake makes 14 days). Such measurements were performed in 8 recuperation periods for children in the sanatorium. During each recuperation period 40 to 46 children took “Vitapect” and 42 to 50 children took “Placebo”. The medical part of that program was implemented by the staff of the certified laboratory of the Belarusian academy for post-graduate education of the Ministry for Public Health Services of the Republic of Belarus and by the physicians of the sanatoria “Serebryanye Klyuchi” and “Lesnye Dali”. The parents and their children gave their written consents for WBC radiation measurements, the intake of “Vitapect” and “Placebo” and the examination of 142 children for determination of trace elements contents in blood serum before and after taking preparations.

The statistical processing of the results of WBC measurements and the testing of trace elements contents in blood serum demonstrated that within 14 days intake of “Vitapect” <sup>137</sup>Caesium contents in children were reduced (up to 40%) and the positive balance of K, Cu, Zn, Fe was kept, there was no reduction of them.

These results were submitted to Ministry for Public Health Services of the Republic of Belarus and given in the information list of the IRS BELRAD No.28 (V.B. Nesterenko, 2005).

It was very important to make sure that such cures for decreasing radiation doses would be also effective under conditions when the children take radiocontaminated local foodstuffs at home.

In framework of the international project of the Association “Children of Chernobyl Belarus” (France), the Foundation “Children of Chernobyl” (Belgium), the Mitterrand’s Foundation (France) and the Institute BELRAD from 2001 to 2003 after receiving children’s and their parent’s and local authorities’ consents the cycle of radiation protection was performed for 1400 children of Narovlya and 10 schools which are visited by children from 13 villages of Narovlya district. In the projects there was accepted the schema of rehabilitation recommended in the Methodical recommendations of the Ministries for Public Health Services of the Ukraine and Belarus, namely three weeks of the pectin intake, 2 months break.

As a result of the performance of such radiation protection average specific activity in children of these settlements was decreased in 3 to 5 times. The figures 2, 3, 4 demonstrate the dynamics <sup>137</sup>Caesium average specific activity variations in children in Verbovichi, Golovchitsy and Kirov within the period of their radiation protection by the pectin preparation for all measured children in each settlement for each critical group (group of children of 15 persons with maximal <sup>137</sup>Caesium contamination in the organism).

Those results were reported in Germany, France, Austria, England, Ireland, Italy, Spain and were given in the Information list of the IRS “Belrad” No. 30 (V.B. Nesterenko, 2006).

From 2001 to 2007 the Institute BELRAD in association with the Austrian charitable organisation of the village Lessach (Dr. P. Daublebsky) realized the project “Radiation Monitoring of Children Travelling from Belarus to Austria for Recuperation and Performance of Their Radiation Protection by the Pectin Preparation “Vitapect”. Under this project three groups of children were recuperated in Austria every year. The WBC measurement of <sup>137</sup>Caesium specific activity in children was performed in the WBC laboratory of the Institute BELRAD before departing to Austria and after returning to Belarus.

The table 1 and the figure 5 demonstrate average specific activity variations in children in the whole group and in the critical group during the recuperation in Austria.

From 2002 to 2007 the Institute BELRAD in association with Mrs. O. Findling (Austria) implemented the same project: every year 14 to 16 children were measured on WBC before travelling to Austria, during the recuperation they took the pectin drink “Vitapect” and after returning to Belarus were measured for the second time on WBC. (V.I. Babenko, I.V. Krasnopyorov, 2007).

On the 10<sup>th</sup> of July 2007 14 children were measured on WBC before travelling for the recuperation, all the children received 2 small boxes of the pectin drink “Vitapect-T” and after returning the children were measured on WBC for the second time. Average specific activity after the first WBC measurement was 31.2 Bq/kg, after the second measurement – 21.8 Bq/kg. The decrease of average specific activity in children reached to 30%. The results of the work are described in the express-report of the IRS “Belrad” under the joint project with O. Findling (V.I. Babenko, I.V. Krasnopyorov, 2007).

On the 24<sup>th</sup> of July 2007 the group of children (13 persons from the village Svetilovichi of Vetka district) travelled to Austria for recuperation. Average specific activity of <sup>137</sup>Caesium in children of that group made 53.6 Bq/kg before departing and after returning from Austria, where the children took the pectin drink “Vitapect-2”, – 37.3 Bq/kg. The decrease of average specific activity in children reached to 30%. The results of the work are described in the express-report of

the IRS “Belrad” under the joint project with H. Mitterfellner (V.I. Babenko, I.V. Krasnopyorov, 2007).

From 1997 to 2007 in framework of the program the Institute BELRAD and Dr. L. Knabl (charitable organization “Tirol hilft den Kindern von Tschernobyl”) performed annually the charitable project “Radiation Monitoring and Implementation of Radiation Protection of Children of Rogachyov District Travelling to Austria for Recuperation”.

In 2007 there were 6 groups of children from Minsk, Rogachyov, Mozyr, Kalinkovichi, Serebryanka, Sloboda, Yudichi, Bolshiye Strelki, Ozerany, Khatovnya, Krasny Pakhar, Zarechye, Luchin of Rogachyov district and Nosovichi of Dobrush district of Gomel region. This project had the same task of radiation protection of children by applying the pectin drink “Vitapect” and by performing WBC measurements before departing to Austria and after returning to Belarus. In the table 2 and the figure 6 there are the results of WBC measurements of children in 6 groups (totally 214 persons) who were in Austria for recuperation. The results of the work are given and estimated in the report of the IRS “Belrad” under the Contract No.48 (A.V. Nesterenko, V.I. Babenko, 2007).

For 8 years the Institute BELRAD in association with the charitable organization “Solidarite Bielorussie de Tchernobyl” (France, Normandy, Caen) performed the project “Radiation Monitoring of Children from the Chernobyl Regions of Belarus Travelling to France for Recuperation and Implementation of Their Radiation Protection by the Pectin Preparation “Vitapect”. The results of the monitoring and their estimation are given in the report of the IRS “Belrad” about the estimation of the results of the recuperation of children in France (A.V. Nesterenko, V.I. Babenko, 2007).

The table 3 and the figure 7 demonstrate the data on  $^{137}\text{Caesium}$  specific activity variations in children in years before and after the recuperation in France. Beginning with 2003 the children traveling to France for recuperation took the pectin drink “Vitapect” additionally in spring and autumn at home.

It should be mentioned that the children travelled to France three and more times and taken the pectin the pectin drink “Vitapect” during the recuperation period and again in spring and autumn at home had 60 to 80% decrease of  $^{137}\text{Caesium}$  contents in the organism.

During the recuperation in France in 2004 25 children took the pectin drink “Vitapect” and 23 children – Placebo (vitamins). The children taken “Vitapect” had 37% decrease of  $^{137}\text{Caesium}$  contents, taken Placebo – 16% decrease.

In August 2007 being invited by the charitable organization “Hilfe für Kinder aus Tschernobyl e.V.” (Germany, Weimar) the children from Belarus (Lelchitsy district) and from the Ukraine were recuperated at the Children recuperation centre not far from Berlin. There was received children’s and their parents’ written consent for their WBC measurement and the intake of the pectin drink “Vitapect”. The measurement of 43 children before departing to Germany and after returning to Belarus demonstrated that  $^{137}\text{Caesium}$  specific activity in their organism was decreased from 30.1 Bq/kg to 19.2 Bq/kg, i.e. 36%. The mentioned results are given in the express-report of the IRS “Belrad” about the recuperation of children in Germany (V.I. Babenko, M.A. Kozyrenko, 2007).

Good results concerning the decrease of  $^{137}\text{Caesium}$  contents in children were received while their recuperation abroad and the intake of the pectin drink “Vitapect” within 2 months. The Institute BELRAD in association with the Canadian charitable organization “Sejour Sante Enfants Tchernobyl” performed WBC measurements of 34 children before their departure to Canada for recuperation, provided every child with the pectin drink “Vitapect” and performed the repeated WBC measurement of children when they came back home after two month. Average  $^{137}\text{Caesium}$  specific activity in those children decrease on 50% after 2 months recuperation. The mentioned results are given in the express-report about the joint work of the IRS “Belrad” and Sejour Santé Enfants Tchernobyl (V.I. Babenko, I.V. Krasnopyorov, 2007).

Being invited by the Spanish charitable organization the children from Lelchitsy district were recuperated during two month in Spain. During that recuperation period the children took

the pectin drink "Vitapect" (each child had 2 small boxes). The WBC measurements of 30 children taken "Vitapect" demonstrated that average <sup>137</sup>Caesium specific activity in those children was reduced from 42.1 Bq/kg to 19.6 Bq/kg, i.e. 53% [13]. The mentioned results are given in the express-report about the recuperation of children in Spain (V.I. Babenko and co-authors, 2007).

The fact that the WBC measurements were performed at the WBC laboratory of the Institute BELRAD, having the Accreditation Certificate of the Goststandart of the Republic of Belarus, and that the children took the pectin drink "Vitapect" produced on the laboratory plant at the Institute BELRAD was of fundamental importance (in Belarus there are no enterprises producing pectin drinks).

#### **BEGINNING AND PROSPECTS OF THE JOINT ACTIVITIES OF THE INSTITUTE OF RADIATION SAFETY "BELRAD" IN THE FIELD OF RADIATION SAFETY TOGETHER WITH THE UKRAINE**

In 2006 the Association "Children of Chernobyl" (France) proposed to the Institute BELRAD to participate in the joint project with the Scientific Centre for Radiation Medicine (SCRM) of the Academy for Medical Sciences of the Ukraine (Professors V.N. Korzun and O.N. Perevoznikov). In spring 2006 the Institute "Belrad" delivered 500 small boxes of the pectin drink "Vitapect" for 500 children from 4 schools (villages Vovchkiv, Maryanovka, Lugoviki, Rogovka). In the beginning of April the children were measured on WBCs of the Scientific Centre for Radiation Medicine of the Academy for Medical Sciences of the Ukraine. Maximal accumulation levels reached to 796 to 1362 Bq/kg. During a month the children take the pectin drink "Vitapect" in the morning and in the evening at school canteens. The repeated WBC measurement of children in the beginning of May 2006 demonstrated the 26% decrease of <sup>137</sup>Caesium contents in children from Vovchkiv, 30% - in children from Rogovka, 32% - in children from Maryanovka, 33% - in children from Lugoviki. These results correlate with the same measurements in Belarus very well (O.N. Perevozchikov, V.V. Vasilenko, 2006).

In the beginning of 2007 the same French Association ordered 2000 small boxes of the pectin drink "Vitapect". In November 2007 the Institute BELRAD delivered 2000 small boxes of "Vitapect" to the same 4 schools to give them to children 4 times a year.

The mobile WBC laboratories of the SCRM of the Academy for Medical Sciences and the Institute "Belrad" are going to perform parallel WBC measurements in order to test the efficiency of the decrease of <sup>137</sup>Caesium radionuclides contents in children with 4 times intake of the pectin drink "Vitapect" a year.

#### **CONCLUSION**

The performed estimation of long-term WBC measurements of children in the Chernobyl regions within their recuperation in the national sanatoria and abroad showed that:

- ❖ The application of the usual schema of recuperation in the Republic and abroad (without pectin drinks) gives 15 to 20% decrease of <sup>137</sup>Caesium contents in children;
- ❖ The combination of the well organized dietary pattern of children with the application of pectin drinks permits to increase the efficiency of the recuperation and to decrease <sup>137</sup>Caesium contents in children up to 30 to 40%;
- ❖ The prolongation of the duration of recuperation of children abroad up to 2 months applying pectin drinks leads to the 50 to 53% decontamination of children's organisms;
- ❖ Radiation protection of children is more effective when they take pectin drinks 2 or 3 times at home and spend one month being recuperated in countries consuming uncontaminated foodstuffs and taking pectin drinks.

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**TABLE 1**  
 CHANGE OF <sup>137</sup>CAESIUM SPECIFIC ACTIVITY IN CHILDREN BOTH IN THE WHOLE AND  
 THE CRITICAL GROUPS WITHIN THE RECUPERATION IN AUSTRIA

Year	Number of children	Average specific activity (whole group), Bq/kg		Decrease of specific activity, %	Average specific activity (critical group), Bq/kg		Decrease of specific activity, %
		First measurement	Second measurement		First measurement	Второе измерение	
2001	40	147.5	88.3	40	318.1	194.0	39
2002	37	127.2	79.8	37	225.1	150.6	33
2003	46	45.5	28.1	38	96.3	59.8	38
2004	21	32.1	17.0	47	41.0	23.0	44
2005	23	57.1	35.8	37	83.0	55.9	33
2006	33	28.4	17.2	38	54.4	36.0	34
2007	28	24.8	15.7	37	34.4	22.8	34

**TABLE 2**

**RESULTS OF WBC MEASUREMENTS OF 6 GROUPS OF CHILDREN (214 PERSONS  
ALTOGETHER) RECUPERATED IN AUSTRIA**

	Date of departure	Date of return	Number of measured children (arrival)	Av. specific activity, 1st measurement, Bq/kg	Av. specific activity, 2 <sup>nd</sup> measurement, Bq/kg	Decrease of average specific activity, %
1	15.05.07	11.06.07	39	17.8±1.1	14.5±0.8	19
2	20.05.07	17.06.07	45	25.3±1.4	11.3±1.6	55
3	26.05.07	23.06.07	38	28.4±1.2	16.4±1.1	42
4	07.06.07	04.07.07	34	28.0±2.3	20.7±2.0	26
5	13.06.07	10.07.07	33	24.5±1.5	19.0±1.4	22
6	19.06.07	16.07.07	25	25.8±1.5	13.1±1.2	49



**TABLE 3**

CHANGE OF <sup>137</sup>CAESIUM SPECIFIC ACTIVITY IN CHILDREN IN YEARS BEFORE  
AND AFTER THE RECUPERATION IN FRANCE

Year	Average specific activity before the recuperation, Bq/kg	Average specific activity after the recuperation, Bq/kg	Average reduction of the specific activity, %
2002	72.8	26.7	63
2003	44.5	19.3	56
2004	34.2	24.6	28
2005	30.5	19.7	35
2006	34.2	20.1	41
2007	46.4	30.7	34

Figure 1. Decrease of the level of <sup>137</sup>Caesium specific activity in children before and after taking "Vitapect" and "Placebo"

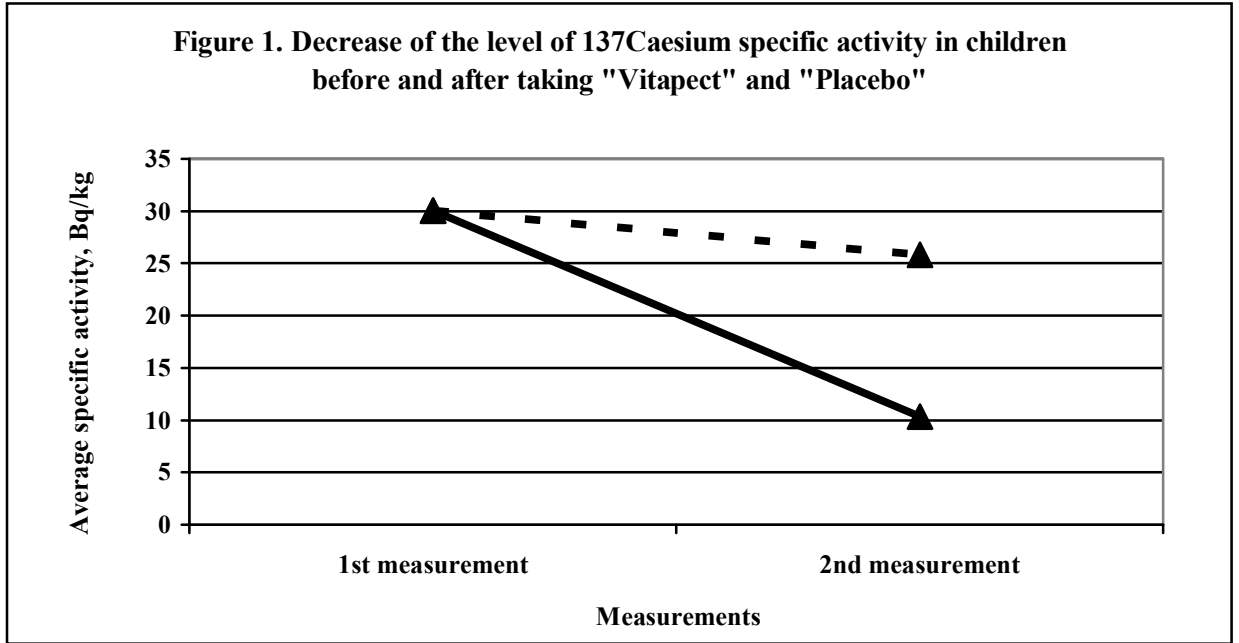


Figure 2. Dynamic of average <sup>137</sup>Caesium specific activity in children in Verbovichi of Narovlya district

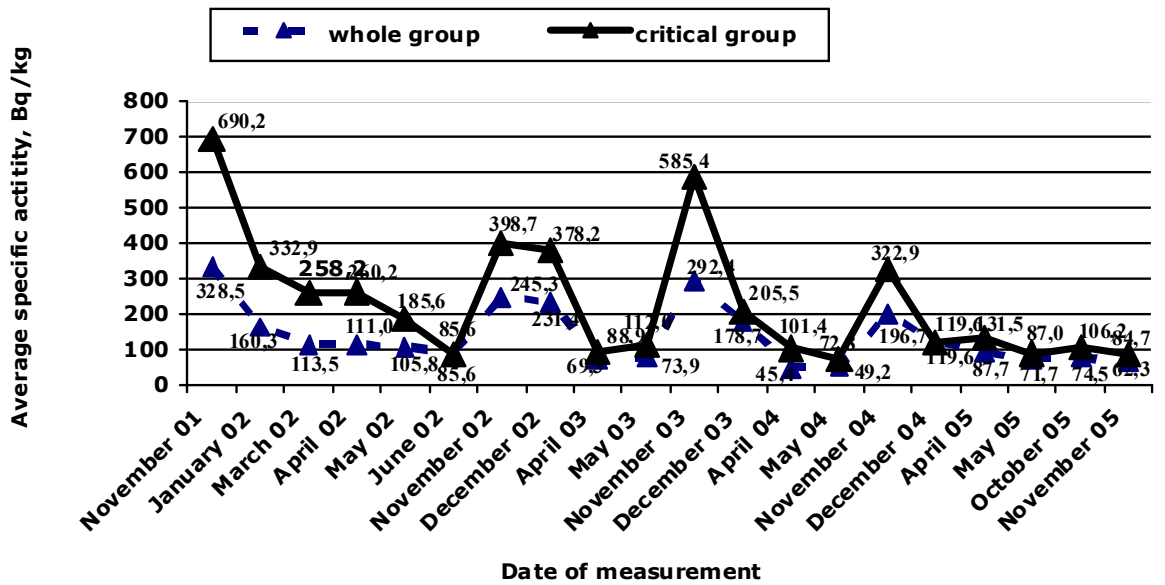


Figure 3. Dynamic of average <sup>137</sup>Caesium specific activity in children in Golovchitsy of Narovlya district

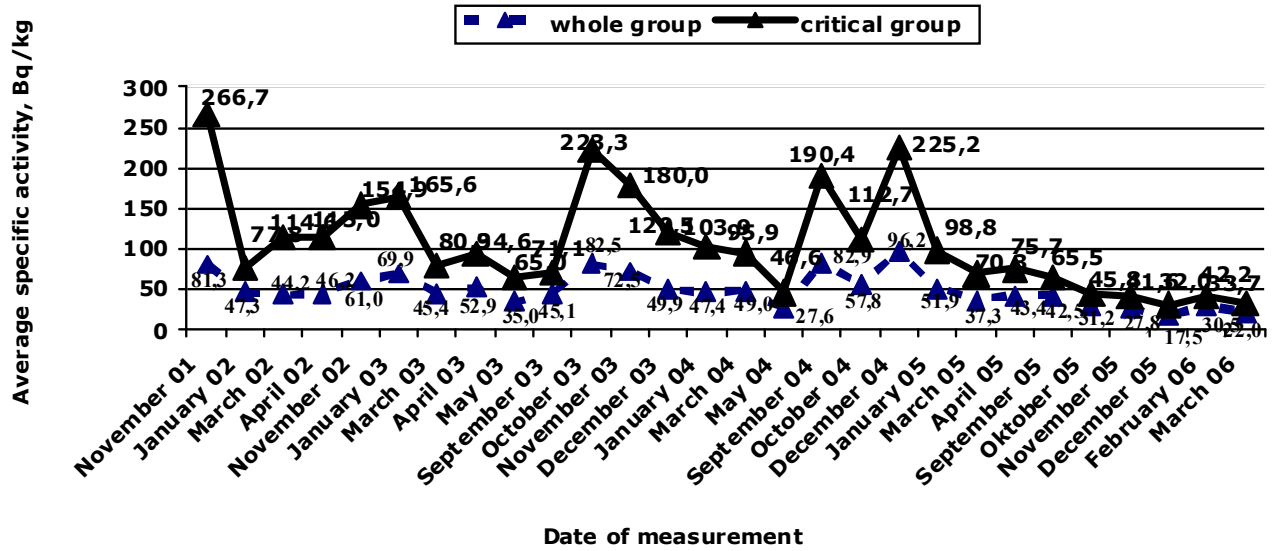
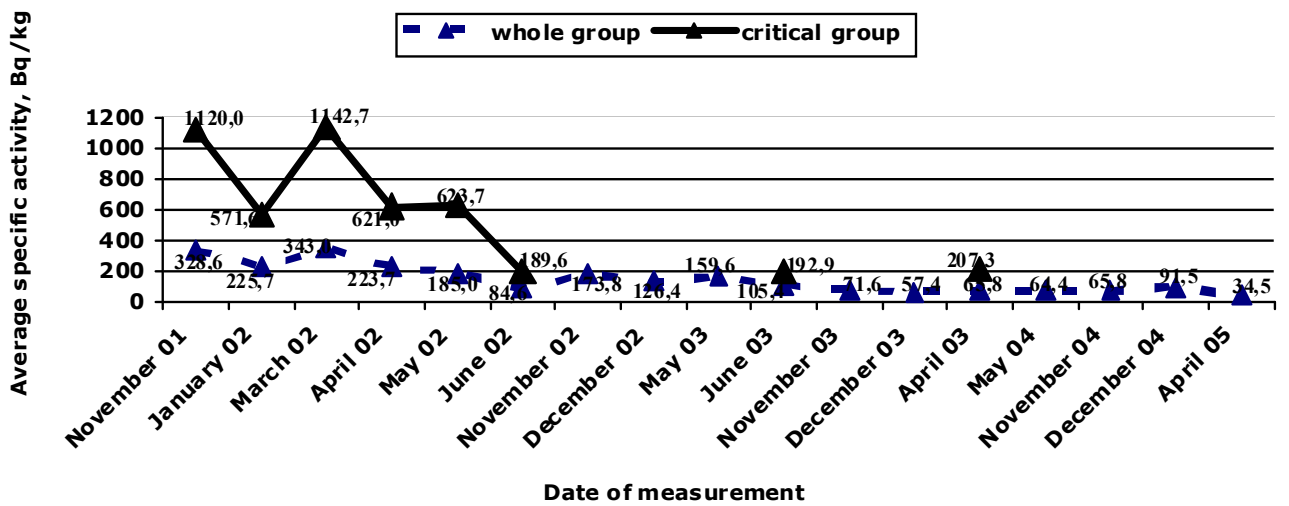
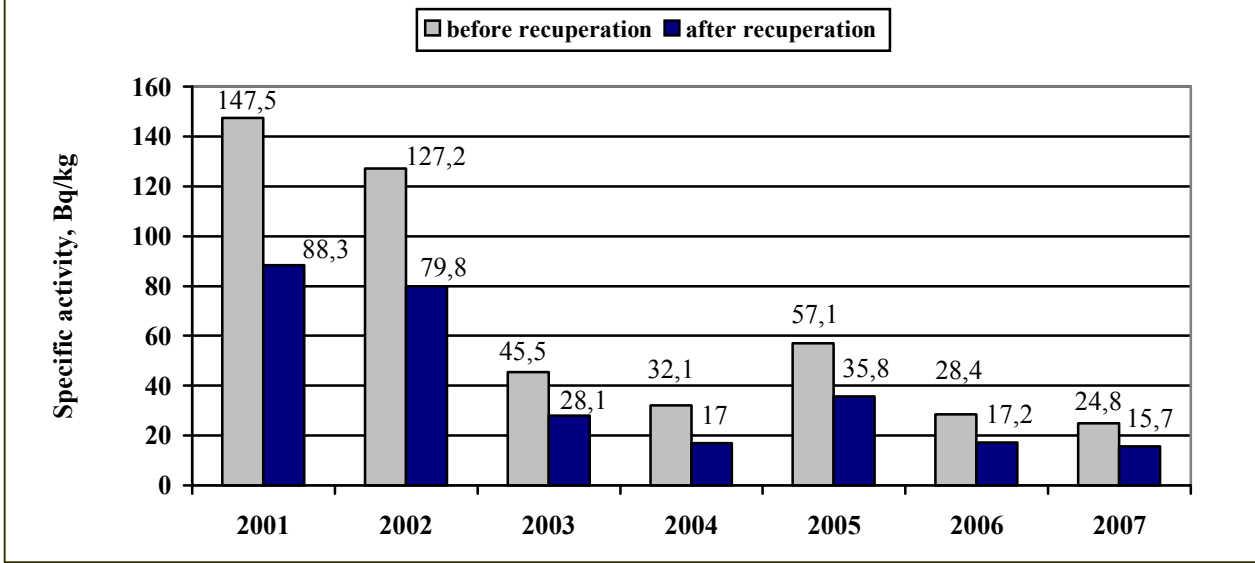


Figure 4. Dynamic of average <sup>137</sup>Caesium specific activity in children in Kirov of Narovlya district



**Figure 5. Dynamics of average specific activity variations according to the data of WBC measurements performed before children's trip to Austria and after their return**



**Figure 6. Dynamics of average specific activity variations according to the data of WBC measurements performed before children's trip and after their return**

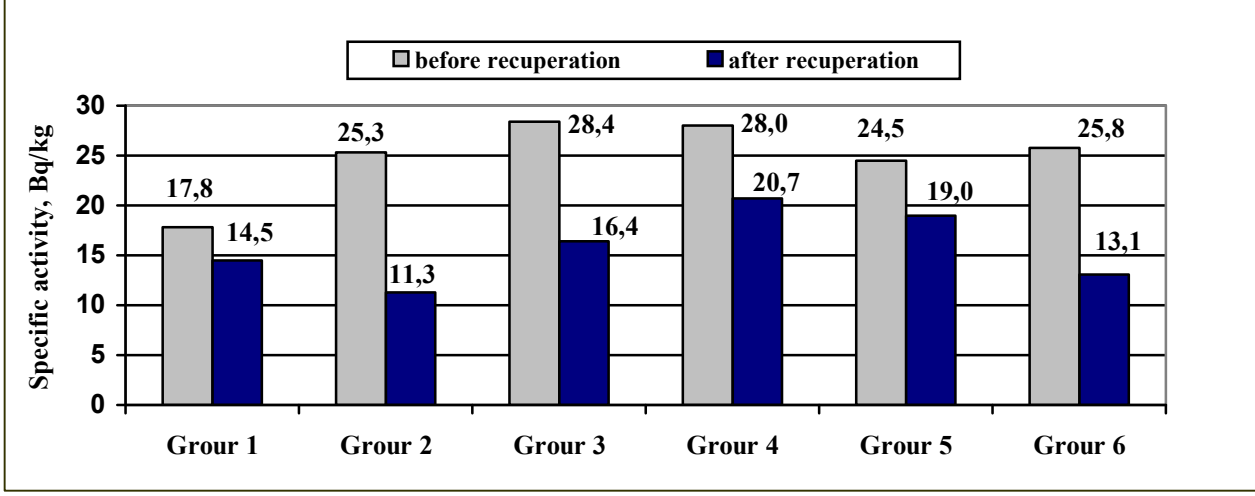


Figure 7. Dynamics of average specific activity variations according to the data of WBC measurements performed before children's trip to France and after their return

