Doses of the Whole Body Irradiation in Belarus As a Result of the Chernobyl Accident

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Abstracts An assessment of the collective and mean individual doses of the whole body irradiation as a result of the Chernobyl accident for children, adults and total population of Belarus are described in the present report. The assessment was carried out on the basis of data on the surface contamination of Belarus and empirical data on contribution of internal exposure to the total irradiation of the whole body. It was found that in case the mixed population of Belarus collective and individual doses achieve some plateaus after 1990. The mean value of the collective dose of the mixed population in the period 1986-2004 is about $2.3 \cdot 10^4$ person-Sv. The mean individual dose of the whole body irradiation of the Belarusian population in this period of time is about 2.3 mSv. In case of the childhood population the whole body irradiation doses decrease since 1990. As a result of this decrease, collective and population doses of children of Belarus decrease to some fractions of background irradiation doses at 2004. The different temporal patterns of the whole body irradiation of different Belarusian subpopulations are determined by demographic factors such as birth, achieving of a definite age by children, death and external and internal migration.

Materials and Methods.

Assessment of the whole body irradiation doses was carried out on the basis of normalized doses of the whole body irradiation. The normalized doses are based on using normalized exposition doses in free air, $P_\gamma(t)$ that is a function of radioactive contamination of territory. The following expression determines normalized doses:

$$h^*(t) = \mu^{-1} \cdot C_1 \cdot C_2 \cdot F_1 \cdot \left[F_2 + (1 - F_2) \cdot F_3\right] \cdot P_\gamma(t). \qquad (1)$$

Here, $h^*(t)$ - the normalized equivalent dose delivered to the whole body at the time t,

μ - the contribution factor of external irradiation to the total dose,

C_1 - the conversion factor for transfer from exposition dose to tissue-absorbed dose,

C_2 - the conversion factor for transfer from tissue-absorbed dose to equivalent dose,

F_1 - the correction coefficient (considers different factors that can influence the exposition dose in air, for example such as soil cultivation etc.),

F_2 - the outdoor occupancy factor (fraction of time spent outside buildings),

F_3 - shielding factor of buildings,

$P_\gamma(t)$ -the exposition dose in a free air at the height 1 meter above the ground at the time t estimated for contamination level in the isotope ^{137}Cs equal to 37 kBq/m^2 at the end of April 1986.

Data on exposition doses in free air assessed in the report [1] for so-called "caesium spot" were used in the present report for calculation of normalized doses. They were estimated for real composition of radionuclides deposited in Belarus as a result of the Chernobyl accident [2]. In the process calculating $P_\gamma(t)$ values, all radionuclides that gave some measurable contribution to the total exposition in 1986 were considered [1]. They are ^{131}I, ^{132}Te, ^{103}Ru, ^{106}Ru, ^{140}Ba, ^{134}Cs and ^{137}Cs. According to data [1] the short-lived isotopes ^{131}I, ^{132}Te, ^{103}Ru, ^{106}Ru, ^{140}Ba and ^{134}Cs determined approximately 85% of the summary exposition dose in the period from 26 April 1986 to 31 August 1986, while approximately 20% in the period from 26 April 1986 to 31 December 1986. The isotope ^{137}Cs was taken after the accident at the Chernobyl NPP as an indicator of the radioactive contamination. Therefore, only this isotope is mentioned here and below by characterizing of radioactive contamination despite the fact that contribution of other isotopes to irradiation doses is also included.

Individual dose at any arbitrary level of radioactive contamination of territory can be assessed by using of the formula:

$$h(t) = \frac{A_0^{137}}{37} \cdot h^*(t). \quad (2)$$

Here, $h(t)$ is the equivalent dose of the whole body irradiation on the territory with contamination in the isotope ^{137}Cs equal to A_0^{137} kBq/m^2 at the end of April 1986 delivered at the time *t*. It is the arithmetic mean dose of the whole body irradiation of population living on the territory contaminated with the isotope ^{137}Cs to the level A_0^{137} kBq/m^2. This is the mean individual dose for this territory. Multiplication of $h(t)$ with the number of irradiated persons gives the collective equivalent dose of the whole body irradiation delivered at the time *t*:

$$H_t^{Coll} = h(t) \cdot N_t. \quad (3)$$

The total collective dose of irradiation delivered to the whole body during some time period can be determined by summing data estimated with the formula (3). It is to be noticed here that in case of long-term irradiation some special procedure has to be used for correct estimation of the collective doses received by irradiated population for some time period. The use of direct summing of data estimated on the basis of the formula (3) can cause a significant overestimation of the collective dose delivered in some finite time. Data on population numbers given in statistical handbooks [3-6] were used in the present report by estimation of collective doses.

Results and discussion.

Irradiation doses.

All contaminated territories in Belarus were divided after the accident at the Chernobyl NPP in clean territories, characterized by contamination level in ^{137}Cs at the end of April 1986, A_0^{137}, less than 37 kBq/m^2 (1 Ci/km^2), and contaminated territories, characterized by contamination level in ^{137}Cs equal or higher than 37 kBkBq/m^2 (1 Ci/km^2) [7]. Contaminated territories in Belarus were then divided in following categories: $37 \le A_0^{137} \le 185$ kBq/m^2, $185 \le A_0^{137} \le 555$ kBq/m^2, $555 \le A_0^{137} \le 1{,}480$ kBq/m^2, $A_0^{137} > 1{,}480$ kBq/m^2.

Table 1 gives annual total (external plus internal) individual dose of the whole body irradiation of rural inhabitants living in areas with these levels (fourth, fifth and sixth column) and specific values of contamination. The second column is doses of irradiation of rural inhabitants living in areas with the contamination level in ^{137}Cs equal to 3.7 kBq/m^2, which is approximately the same contamination with ^{137}Cs existed in Belarus before the Chernobyl accident. It was resulted from the atmospheric test of atomic weapon [8]. The third column of Table 1 gives the mean individual doses of the whole body irradiation for the territory with the contamination level equal to 37 kBq/m^2 or normalized doses assessed for rural inhabitants of Belarus.

Table 1. Annual mean individual equivalent doses of the whole body irradiation of rural inhabitants of Belarus (mSv/a).

Year	Level of ^{137}Cs contamination, kBq/m^2 (*Ci/km^2*)					
	3.7 (*0.1*)	37 (*1*)	37-185 (*1-5*)	185-555 (*5-15*)	555-1,480 (*15-40*)	1,480 (*40*)
1986	0.0972	0.9719	2.896	8.339	23.62	51.22
1987	0.0468	0.4681	1.395	4.016	11.37	24.67
1988	0.0296	0.2957	0.8812	2.537	7.186	15.58
1989	0.0181	0.1806	0.5382	1.549	4.388	9.517
1990	0.0104	0.1042	0.3104	0.8938	2.531	5.490
1991	0.0089	0.0885	0.2639	0.7597	2.152	4.666
1992	0.0079	0.0772	0.2302	0.6628	1.877	4.071
1993	0.0069	0.0686	0.2043	0.5883	1.666	3.614
1994	0.0062	0.0621	0.1849	0.5324	1.508	3.270
1995	0.0057	0.0570	0.1698	0.4890	1.385	-
1996	0.0053	0.0531	0.1583	0.4556	1.290	-
1997	0.0049	0.0495	0.1475	0.4247	1.203	-
1998	0.0047	0.0469	0.1397	0.4021	1.139	-
1999	0.0044	0.0443	0.1319	0.3799	1.076	-
2000	0.0043	0.0425	0.1267	0.3647	1.033	-
2001	0.0041	0.0405	0.1206	0.3472	0.983	-
2002	0.0039	0.0389	0.1160	0.3339	0.946	-
2003	0.0038	0.0382	0.1138	0.3277	0.928	-
2004	0.0036	0.0362	0.1078	0.3104	0.879	-
1986-2004	0.2764	2.7639	8.2364	23.7141	67.162	110.555

Conversion factors C_1 and C_2 used for assessment of normalized doses were taken from the report [9]. The coefficient F_1 = 0.368 was accepted for the period 1990-2004. This value was assessed in the report [1] on the basis of empirical data. For the period 1986-1990, the value of the factor F_1 was assumed to linearly change from 1 to 0.368. The coefficient F_2 equal to 0.295 was accepted as the occupancy factor of rural inhabitants of Belarus [10,11]. The value of shielding factor for rural inhabitants in Belarus was taken equal to 0.212. It was also assessed on the basis of empirical data [1]. The coefficient μ characterizing contribution of the external irradiation equal to 0.736 was used in assessments. This value was assessed on the basis of empirical data given in the report [12].

Estimation of mean individual doses of rural inhabitants living in territories with contamination levels 37-185, 185-555 and 555-1480 kBq/m^2 (fourth, fifth and sixth columns of Table 1) was performed on the basis of respective average contamination levels. They are 110.2, 317.5 and 899.1 kBq/m^2, respectively, at the end of April 1986. These values were estimated on the basis of data given in the report [1] on the basis of empirical data [13].

Data given in the sixth column of Table 1 allow to assess the individual dose of the whole body irradiation accumulated in the period 1986-1995 for persons living in the area with the level of contamination 555-1480 kBq/m^2. It is 57.7 mSv.

The Russian specialists [14] estimated the cumulative dose of the whole body irradiation of rural inhabitants lived in 1986-1995 in territories with the same level of contamination equal to approximately 60 mSv. This is practically the same as irradiation dose estimated for rural inhabitants of Belarus living in the area with the level of contamination 555-1480 kBq/m^2.

A very good agreement in data assessed for the Belarusian rural inhabitants and data estimated by the Russian specialists [14], which used more sophisticated model, justifies the simplified method of the whole body irradiation described in the present report.

As can be seen from Table 1, assessment of irradiation doses for inhabitants of the territory with the level of contamination 1,480 kBq/m^2 was performed only for the period 1986-1994. This was because all residents of territories contaminated with 1,480 kBq/m^2 and higher were resettled to clean areas in Belarus in 1990-1994 [15]. According to our assessment, the mean individual dose accumulated by them before resettlement is approximately 100 mSv.

Data presented in Table 1 show that mean arithmetic individual doses of the whole body irradiation of rural inhabitants of Belarus accumulated in 1986-2004 vary from some fractions of millisivert to hundreds of millisivert. In some cases inhabitants of the Belarusian rural settlements accumulated much higher doses of the whole body irradiation for much shorter periods of time. Assessment made on the basis of the method described in this report gives for inhabitants of the rural settlement Vysoki Borak the population dose of the whole body irradiation equal to 135 mSv. This dose was accumulated in the period 1986-1990. The population dose of the whole body irradiation in the same period in case of inhabitants of the rural settlement Chudzyany is approximately 295 mSv. The settlement Vysoki Borak is situated in the Krasnopolie district of the Mogilev region approximately 230 kilometers from the Chernobyl NPP. The settlement Chudzyany is situated in the Cherikov district of the Mogilev region approximately 250 kilometers from the Chernobyl NPP. The average contamination of the settlement Vysoki Borak was 2,480 kBq/m^2 and of the settlement Chudzyany 5,420 kBq/m^2 [13].

It is well known that maximum individual doses often exceed the mean dose by a factor of 3-5 [16]. This means that some inhabitants of the rural settlement Chudziany received doses of the whole body irradiation up to 1,500 mSv. In this respect they are comparable with atomic bomb survivors.

Table 2 presents collective doses of rural and urban inhabitants of Belarus in 1986-2004, collective doses of the total population of Belarus (sixth column) as well as mean individual doses of the whole body irradiation of the entire Belarusian population in this period (seventh column). The data in the seventh column of Table 2 were calculated by dividing the data given in the sixth column by the total population of Belarus.

The following simplified method was used for assessment of data presented in Table 2. The entire Belarusian population was divided into two subpopulations: rural and urban subpopulations. Normalized doses of the whole body irradiation of rural and urban subpopulations were assessed separately for these two subpopulations. In case of rural subpopulation the same values of coefficients F_2 and F_3 as in previous assessment (Table 1) were taken. For assessment of the normalized doses for urban inhabitants of Belarus coefficient F_2 equal to 0.2 and coefficient F_3 equal to 0.1 were used [11].

Calculation of population doses for urban subpopulation was performed for an average contamination of the Belarusian territory equal to 78.42 kBq/m^2. This value was estimated from the total amount of the ^{137}Cs isotope deposited in Belarus [1]. Values of collective doses of the urban population of Belarus were calculated for the average contamination equal to 37 kBq/m^2 [11].

Table 2. Annual normalized and collective irradiation doses of the Belarusian population as a result of the Chernobyl accident.

Year	Rural population		Urban population		Total Population	
	Normalized dose, mSv	Collective dose, PSv	Normalized dose, mSv	Collective dose, PSv	Collective dose, PSv	Individual dose, mSv
1986	0.9719	7,749	0.6133	3,818	11,567	1.1583
1987	0.4681	3,732	0.2954	1,839	5,571	0.5547
1988	0.2957	2,358	0.1866	1,162	3,520	0.3489
1989	0.1806	1,440	0.1140	709	2,149	0.2117
1990	0.1042	617	0.0657	409	1,026	0.1007
1991	0.0886	491	0.0559	348	839	0.0823
1992	0.0773	400	0.0488	303	703	0.0689
1993	0.0686	330	0.0433	269	599	0.0585
1994	0.0621	275	0.0392	244	519	0.0507
1995	0.0570	232	0.0360	224	456	0.0447
1996	0.0531	216	0.0335	209	425	0.0418
1997	0.0495	201	0.0312	194	395	0.0389
1998	0.0469	191	0.0296	184	375	0.0372
1999	0.0443	180	0.0279	174	354	0.0352
2000	0.0425	173	0.0268	167	340	0.0339
2001	0.0405	165	0.0255	159	324	0.0324
2002	0.0389	158	0.0246	153	311	0.0313
2003	0.0382	156	0.0241	150	306	0.0309
2004	0.0362	147	0.0228	142	289	0.0293
1986-2004	2.7639	19,211	1.7442	10,857	30,068	2.9900

Data presented in the sixth column of Table 2 gives for the period 1986-1995 the collective dose of the whole body irradiation as a result of the Chernobyl accident 26,949 PSv. This value is by 28,7% higher than the collective doses assessed for Belarus for the same period in the report [12]. The authors [12] carried out detailed study of irradiation doses in different regions of Belarus and estimated the total collective dose of the whole body irradiation of the Belarusian population equal to 20,940 PSv. However, they studied only inhabitants of rural and urban settlements situated in territories with the contamination level with ^{137}Cs equal or higher than 37 kBq/m^2. On the contrary, data shown in Table 2 were assessed for all contaminated territories of Belarus. Our assessment included also areas with the contamination level less than 37 kBq/m^2. Additionally, the method of assessment described in the present report considered also on an indirect way the irradiation of persons that worked as liquidators in the 30-km zone in 1986-1989. This was done by including radioactive nuclides deposited in the Belarusian part of the 30-km zone for the estimation of the average contaminated level in case of rural inhabitants of Belarus. Excluding of the 30-km zone as well as areas contaminated to levels less than 37 kBq/m^2 gives practically the same collective dose as it was estimated by authors [12].

The very good agreement between the data assessed in this report and the data estimated in reports [12,14] allows to conclude that reliable data characterizing irradiation of affected inhabitants of Belarus are established.

Data in the sixth and seventh column of Table 2 can be used for estimation of cumulative collective and individual doses of the whole body irradiation of the Belarusian population for any period of interest. Direct summing of data presented in these columns, however, does not give correct doses unless two opposite processes for dose accumulation are taken into consideration. The first process is positive accumulation of irradiation doses year by year. The second process is loosing of already delivered doses as a result of demographic processes. The influence of demographic processes can be demonstrated for irradiation of the Belarusian population in 2004. According to the data of Table 2, the collective dose of the whole body irradiation of the Belarusian population in 2004 was approximately 289 person-Sv. The cumulative mean individual dose for the period 1986-2004 was 2.99 mSv (seventh column of Table 2). 140,064 persons died in Belarus in this year. It is well known that older people give the main contribution to the mortality in each country. Therefore it is possible to assume that all people that did in Belarus were alive at the time of the Chernobyl accident. This means that the individual dose accumulated by persons who died in 2004 is practically the same as the cumulative the dose delivered in the period 1986-2004, which is 2.99 mSv (seventh column of Table 2). Multiplying of this value with a number of people that died in 2004 gives the collective dosed loosed by the Belarusian population in 2004 equal to 418.8 persons-Sv. This is by 129.8 person-Sv larger than that delivered to the whole Belarusian population in 2004.

The influence of demographic processes on the cumulative irradiation doses can be much more significant in case of “truncated” populations that include persons with some definite age. The population of children gives an example of such populations. It contains only persons at the age less than 15 years. Consequently, the children’s subgroup in 2004 contained only children who were born after 1989 when doses of the whole body irradiation in Belarus were much lesser than in 1986-1989. The loosing of high-

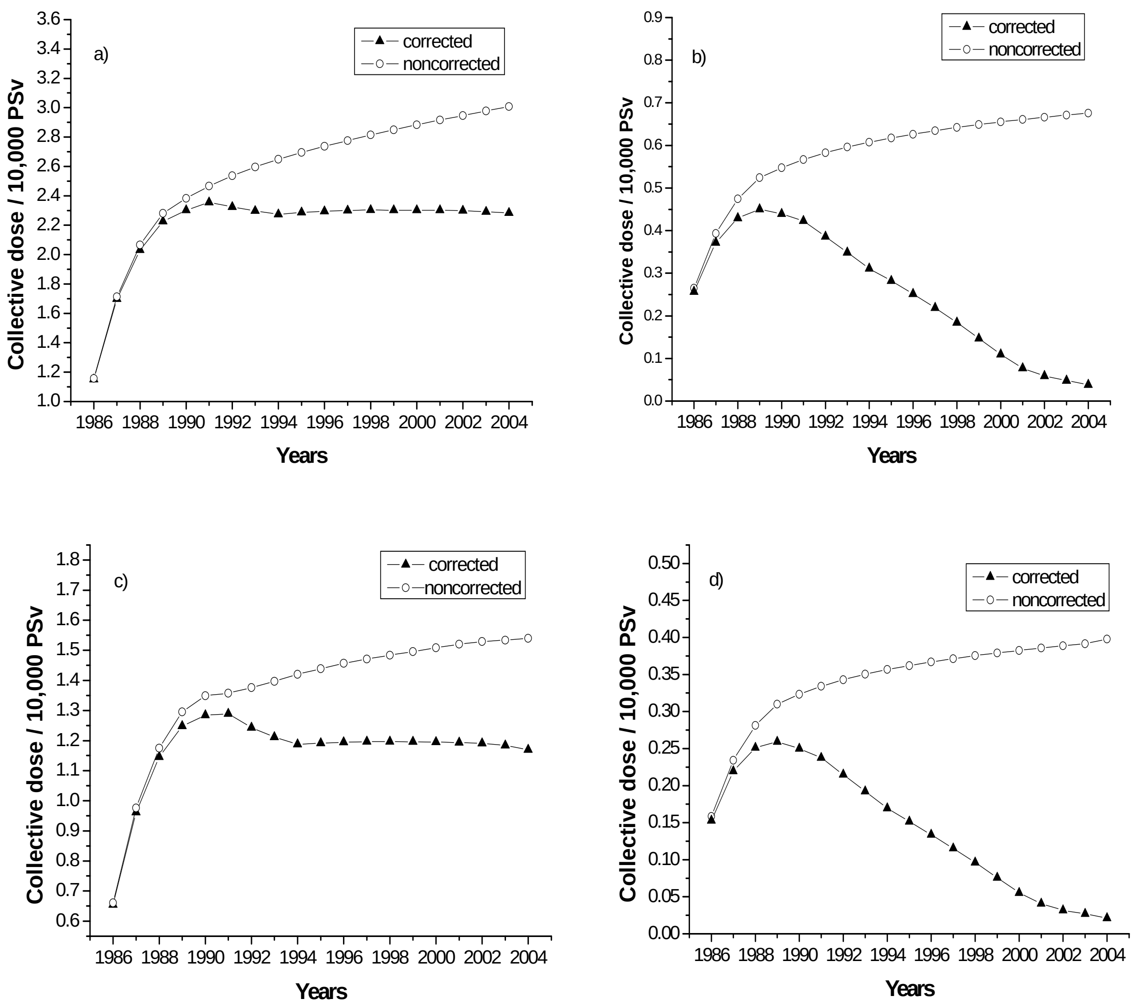

Fig.1. Collective equivalent doses of the whole body irradiation in Belarus as a result of the Chernobyl accident: a) total population of Belarus, b) children of Belarus, c) total population of the Gomel region, d) children of the Gomel region.

irradiated children decreases the cumulative doses of the subgroup of children.

As can be seen from here, different concepts of cumulative doses have to be distinguished in case of chronic irradiation. The first concept is a cumulative dose that was delivered to the population living on some contaminated territory. In the second concept, cumulative dose was possessed by the population during certain time when they live on some contaminated territory. In the first concept one needs only to determine the sum of doses delivered in the period of interest. In the second concept, cumulative doses of irradiation are some functions of time one needs to take into account about demographic processes. Fig.1 and Fig.2 demonstrate collective and population doses of irradiation of the entire Belarus and of the Gomel region assessed for these two different concepts.

In case of the Gomel region the same method of assessment as in case of the entire Belarus was used in estimation of the data presented in Fig.1 and Fig.2. It was also assumed that normalized doses of the whole body irradiation are the same for children as for adolescents and adults.

Figure 1 demonstrates influence of demographic processes on collective doses of the whole body irradiation of the entire population of Belarus as a result of the Chernobyl accident. The subscript “corrected” in Fig.1 refers to data assessed by considering of demographic processes mentioned above. The subscript “noncorrected” denotes in case of the entire Belarus data assessed by simple summing up values presented in Table 2.

The influence of the natural demographic processes on mean individual doses of Belarus and the

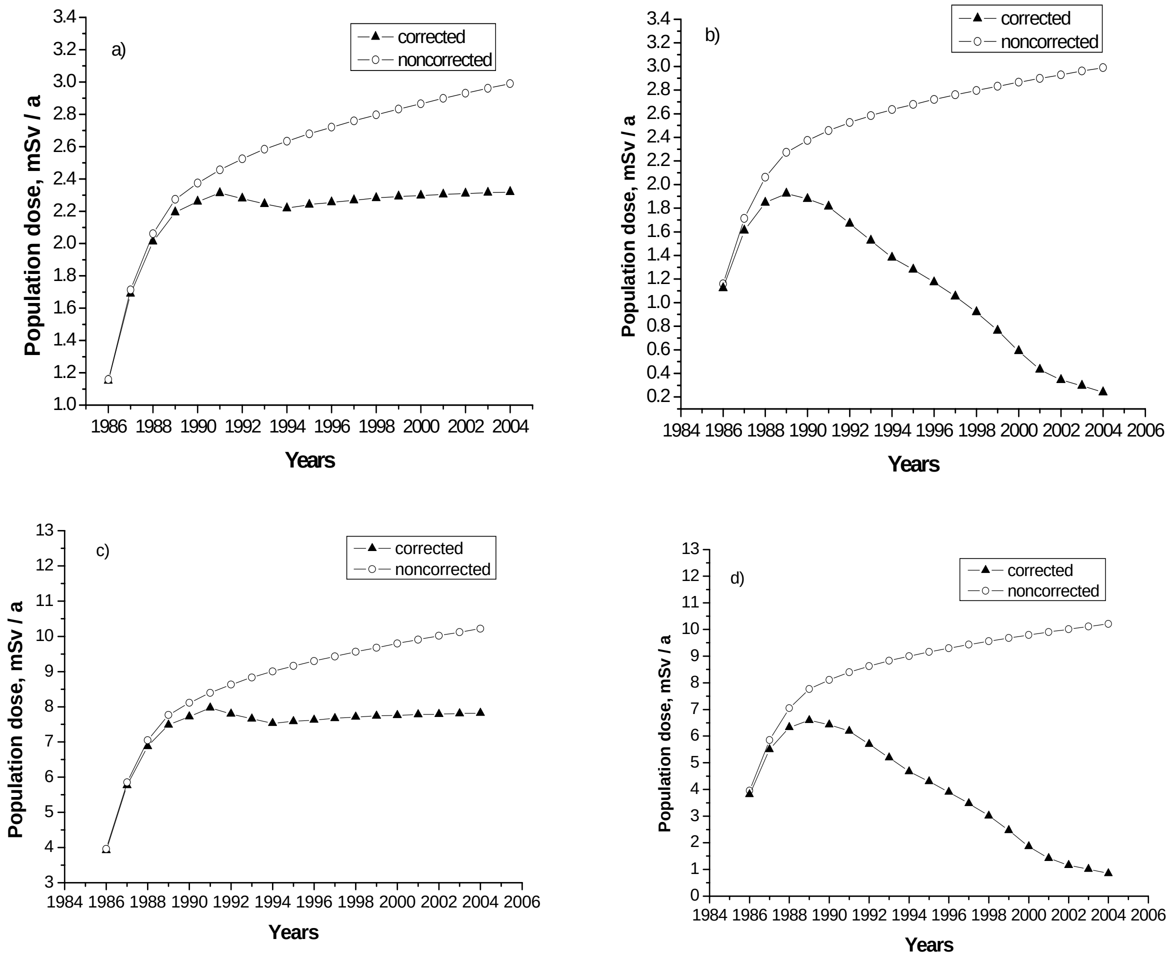

Fig.2. Mean individual (population) equivalent doses of the whole body irradiation in Belarus as a result of the Chernobyl accident: a) total population of Belarus, b) children of Belarus, c) total population of the Gomel region, d) children of the Gomel region.

Gomel region is shown on Fig.2.

As can be seen from Fig. 1, collective doses of the whole body irradiation in case of total populations of Belarus as well as the Gomel region increase up to 1991 and then remain practically constant showing some plateaus in the time period 1991-2004. Our assessment shows that the same temporal patterns demonstrate also collective doses of the whole body irradiation of entire populations of other regions of Belarus.

On the contrary, "noncorrected" collective equivalent doses in case of total populations of Belarus and the Gomel region demonstrate the further increase after 1990 although it is much slower than in 1986-1990. Comparison of "corrected" and "noncorrected" collective doses assessed for the entire population of Belarus as well as for the Gomel region shows that "noncorrected" collective doses in 2004 are by approximately 20% higher than "corrected" doses. This difference correlates with number of people that died in the period 1987-2004. Assessment on the basis of statistical handbooks [5,6] shows that 2,239,782 persons died in Belarus in this period. This is about 22.7% from the total number of the Belarusian population averaged for the period 1987-2004 (approximately 10,000,000 persons).

Quite different situation arises in case of children's population. Here "corrected" collective equivalent doses increases up to 1989 and then decreases rapidly to very small values after 2000. For example, "corrected" collective equivalent doses of children's populations of Belarus and the Gomel region in 2004 were by one order in magnitude less than in 1989. Such significant decrease of collective doses resulted from the "loss" of persons who were children in 1986-1989 and left the children's population before 2004 as a result of their transition to the population of adolescents and adults.

The same temporal patterns demonstrate mean individual doses of the whole body irradiation, which can be seen on Fig.2. Such temporal patterns of irradiation doses of children indicate that possible medical effects of the Chernobyl accident in children have to be expected only immediately after this accident. Table 3 contains cumulative collective and population doses of the whole body irradiation assessed for children, adults and the mixed population of Belarus for the period 1986 –2004 by considering the described correction procedure.

Table 3. Collective and mean individual doses of the whole body irradiation of different subgroups in Belarus as a result of the Chernobyl accident.

Year	Children doses		Adults doses		Whole population	
	Collective	Individual	Collective	Individual	Collective	Individual
	/10^4 PYSv	mSv	/10^4 PYSv	mSv	/10^4 PYSv	mSv
1986	0.2569	1.1220	0.8936	1.1567	1.1505	1.1520
1987	0.3722	1.6107	1.3255	1.7091	1.6977	1.6905
1988	0.4297	1.8457	1.6014	2.0545	2.0311	2.0130
1989	0.4501	1.9230	1.7767	2.2691	2.2267	2.1934
1990	0.4396	1.8772	1.8633	2.3744	2.3029	2.2602
1991	0.4228	1.8132	1.9334	2.4591	2.3562	2.3123
1992	0.3863	1.6696	1.9380	2.4523	2.3243	2.2791
1993	0.3489	1.5254	1.9490	2.4509	2.2978	2.2452
1994	0.3109	1.3818	1.9624	2.4600	2.2733	2.2192
195	0.2821	1.2804	2.0056	2.5097	2.2876	2.2404
1996	0.2516	1.1723	2.0438	2.5504	2.2953	2.2554
1997	0.2192	1.0531	2.0820	2.5907	2.3011	2.2689
1998	0.1843	0.9197	2.1196	2.6279	2.3038	2.2826
1999	0.1471	0.7631	2.1556	2.6595	2.3027	2.2923
2000	0.1097	0.5898	2.1926	2.6921	2.3023	2.2979
2001	0.0771	0.4318	2.2252	2.7187	2.3023	2.3045
2002	0.0588	0.3445	2.2400	2.7260	2.2988	2.3102

Assessment on the basis of data presented in the sixth column of Table 3 gives for the period 1990-2004 the mean time-averaged collective dose of the whole body irradiation of the Belarusian population as a result of the Chernobyl accident equal to $2.3 \cdot 10^4$ person-Sv. Data shown in the seventh column of Table 3 gives as the mean time-averaged mean individual dose of the whole body irradiation for this period equal to 2.28 mSv.

It is evident that the described method of correction can not give fully correct doses of the whole body irradiation because it does not take in account other important factors that influence the accuracy of assessed values. Significant influence on the correctness of dose assessment has internal (movement to other regions of Belarus) and external (movement to other countries) migration of inhabitants of contaminated areas. It began soon after the Chernobyl accident. As a result, a large fraction of people migrated from territories affected by the Chernobyl accident. For example, one sixth of inhabitants of the Slavhorod district (Mogilev oblast) left their contaminated settlements during the first three years after the accident [17]. The similar situation arose in other contaminated districts of the Mogilev oblast. The process of migration was even more pronounced in contaminated areas of the Gomel oblast [18].

According to the official information, the number of people that changed their place of residence in borders of Belarus in 1986-2000 reached 1,500,000, while the averaged total number of people in this period in Belarus equal to 10 millions. 675.1 thousand of people migrated in 1990-2000 from Belarus to other countries of the world. Out of this number, 524 thousand of people migrated to countries of the Community of Independent States (CIS) and 151.1 thousand of people immigrated to countries beyond the bounds of the former USSR. For example, approximately 130 thousand of persons of the Jewish nationality immigrated to Israel from the contaminated areas in Belarus and the Ukraine [19]. About 50% persons from this number have immigrated to Israel from Belarus.

The internal migration from the contaminated areas of Belarus was occurring with a partial assistance of the state. On this way approximately 135,000 persons had left the territories strongly affected by the Chernobyl accident with the support of the state [20]. About 200,000 persons migrated from contaminated areas without assistance of the state [20].

The external and internal migration causes significant incorrectness in assessment of irradiation doses carried out by using the method based on contamination levels. The external migration decreases collective and population doses of the affected populations because of a transfer of irradiation doses to other countries. This transfer means a “loss” of radiation risk for Belarus. This means that using doses presented in Table 3 assessed without taking in account the loss of some fractions of doses will cause an underestimation of radiation risks.

The internal migration does not cause such underestimation of radiation risk because the transfer of irradiation doses between different regions of Belarus causes only leveling of radiation risk in different regions of Belarus. However, the internal migration causes decrease of statistical power of analysis because it disturbs the correlation between levels of contamination and incidence rates of analyzed diseases. The effect of internal migration can even exclude the possibility of using of standard method of analysis based on comparison of incidence rates in contaminated and not contaminated regions.

Conclusions

Collective and individual doses of the whole body irradiation of the Belarusian population were assessed on the basis of contamination of Belarus caused by the accident at the Chernobyl NPP. Assessment was carried for the period 1986-2004 years. The influence of such demographic factors as birth, achieving of the age 15 years by children as well as death was taken into account in course of assessment. Estimated results demonstrate that in case of children collective and individual doses increase in the period 1986-1989 and then decrease practically to fractions of collective and population doses of the background irradiation. The collective and individual doses in case of adults of Belarus demonstrate a significant increase in the period 1986-1989 and changed with some weak increase after 1990. The collective and individual doses of the whole population of Belarus increase in the period 1989-1989 and then remain practically constant up to 2004.

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