

Creation of the Uniform Chernobyl register of Russia and Belarus

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Abstract: Creation of operation of uniform medical and dosimetric data banks for carrying out of collateral widescale radiation epidemiological researches and prediction of medical consequences of Chernobyl accident (ChA) in territory of Russia and Belarus.

On the basis of medical and dosimetric data banks of the national registers of Russia and Belarus the uniform technology of collection personal of a state information of health of the population, injured from ChA .

Three levels of observation are created. The first level - Bryansk area of Russia and Gomel area of Belarus, interests of research - radiation hazards of oncologic diseases of various localizations for the population living in these territories. The second level - Bryansk, Kaluga, Tula and Oryol area of Russia and Brest, Vitebsk, Gomel, Grodno, Minsk and Mogilyov area of Belarus, preferred direction of researches - thyroid cancer. The third level - all territory of Russia and Belarus, area of research - medical consequences for health of the liquidators, their children and persons migrating from polluted territories. Personal uniform subregisters are created and function on a stationary value to a basis. Is subregisters containing information about diseases by a thyroid cancer, leukemia and breast cancer, uniform register of the liquidators and their children, uniform cancer-register of the liquidators and uniform cancer-register of the population living in territories with density of contamination on Cs 137 more than 185 kBq/m². The personal information on 20440 cases of thyroid cancer, 5234 cases of a leukemia, 16679 cases of breast cancer, 252884 liquidators, 6882 cases of a cancer of various localizations among the liquidators, 35423 children of the liquidators, 11407 cases of oncologic diseases among the population living in territories with density of contamination on Cs 137 more than 185 kBq/m² is accumulated.

KEYWORDS: *Uniform Chernobyl register, Russia, Belarus, cancer, disease, liquidator, population, injured from Chernobyl accident*

1. Introduction.

The technical activity of the man connected to manufacture of a nuclear energy, with mass use of radionuclides and other sources of ionizing radiation in an industry, medicine, agriculture, has caused essential increase of a radioactive background. However by major additional source of radiation was the accident of 1986 on Chernobyl atomic power station - largest on scales of pollution of an environment [1].

Estimation of the current condition and forecasting of the remote medical consequences of an irradiation of the population owing to accident on Chernobyl atomic power station have the large social and economic importance, as to influence of radiation millions people have undergone. Therefore for activity of organ of public health services there was necessary a task of revealing of possible influence of the radiating factor, and, first of all, of low doses of ionizing radiation, on population a level. The increasing theoretical and practical interest is represented by development of the forecast of a condition of health of the population which has undergone to radiating influence owing to Chernobyl accident (ChA). In the decision of this problem the important place occupy epidemiological and demographic researches of various categories of the population, of the injured as a result of accident on Chernobyl atomic power station [2].

By the basic source of the information, on the basis of which the modern knowledge of meanings of radiation risks is received is brave also forms of doses dependence, is cohort of the persons who have survived nuclear bombardment in Hiroshima and Nagasaki [3, 4]. Really, the Japanese register in Hiroshima and Nagasaki functions more than 60 years and provides the International Atomic Energy Agency with the necessary information on effects on health of the man after radiating influence on the basis of direct of epidemiological researches. In last 15-20 years in a some of the advanced countries

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of the world (USA, England, France, Canada, Japan) were created the epidemiological registers of the nuclear workers. Their basic task - study of influence of low doses also and radiation risks of cancer and noncancer diseases in view of the factor of an protracted irradiation. It is necessary to note, that the persons survived bombardment in Hiroshima and Nagasaki have undergone to sharp radiating influence in the large doses. However there is a justified doubt that the coefficients of risk incidence radiation - induced by diseases can be applicable to a situation created in Republic of Belarus and in Russian Federation after accident on Chernobyl atomic power station: various capacities and levels of doses, spectrum and energy of sources of an irradiation, various socio - economic conditions, ethnic and geographical features [5].

Hence, for the decision of this problem the definition of radiation risks is necessary on the basis of the medical and dosimetric data saved for the period, past after accident on Chernobyl atomic power station, in the countries former USSR, which territory has undergone to radioactive pollution [2, 6, 7].

After accident on Chernobyl atomic power station in USSR the large-scale program on creation of the All-Union distributed register of the persons who have undergone to influence of radiation as a result of accident on Chernobyl atomic power station (AUDR) was accepted. The parent organization AUDR was formed on the basis of computer center of Institute medical radiology USSR Academy of Medical Sciences (Obninsk). All republics of former Soviet Union, large number of scientific and practical establishments were involved in creation AUDR. By the end of 1991 in AUDR 659 292 men were registered. More than 47 % registered, was necessary on Russian Federation (20,9%, basically it there were Russian liquidators) and Republic of Belarus (26,5%, basically in AUDR the population of the injureds of territories of republic) was included.

Volume and quality registered of the medical and dosimetric information, organizational structure, interdepartmental and territorial interaction in system AUDR allowed to hope, that in 15-20 years the first objective estimations of radiologic consequences of accident on Chernobyl atomic power station will be received on the basis of direct of radiative - epidemiological researches of the liquidators and population of the most polluted territories. But in 1991 year AUDR has stopped the existence owing to disintegration USSR [7].

In the most injureds regions to Ukraine, Belarus and Russia were created independent the personal registers, where the account only of citizens of these countries was carried out.

So, May 5, 1993 by Government of Belarus the decision №283 «About creation of the Belarussian state register of the persons who have undergone to influence of radiation owing to accident on Chernobyl atomic power station » was accepted. September 22, 1993 by Government of Russian Federation the decision № 948 «About state registration of the persons, injureds of radiating influence and undergone to a radiating irradiation in result Chernobyl both other radiating accidents and incidents » also was accepted.

Now basic part of the Belarussian items of information on medical consequences of accident on Chernobyl atomic power station is kept and collects in a database of the Belarussian state register of the persons who have undergone to influence of radiation owing to accident on Chernobyl atomic power station (BSR), finding in Gomel (Republican Research Center of Radiation Medicine and Human Ecology) and Minsk (Republican Research Center of medical technologies), Russian items of information - in a database of the All - Russia medical and dosimetric state register (RNMDR), taking place in Obninsk (Medical Radiological Research Centre, Russian Academy of Medical Sciences).

However today estimation of radiation risks with a high degree of statistical trustworthy only on the basis of the Belarussian or Russian data is problematic because of insufficient statistical power. Therefore it is represented to the justified and expedient creation of the incorporated databases medical, demographic, of the dosimetric information of the national registers of two countries and realization joint of radiative - epidemiological researches. The construction large-scale of the epidemiological registers, and furthermore association of various databanks having the information structure and a programing-technical complex, is enough difficult task.

2. Materials and methods

In 1998 works on creation Uniform Chernobyl of the register of Russia and Belarus (UChR) for the first time were begun.

The concept “uniform” means identity of formats of a storage and display of the certain kind given, criteria of selection and ways of the analysis of the information ensuring an opportunity of an

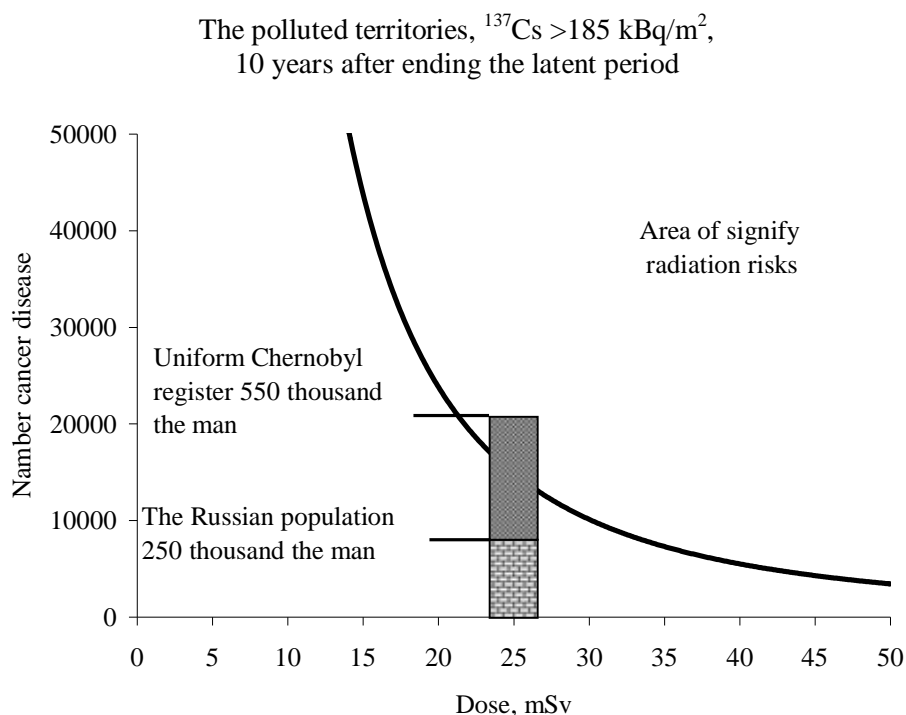
information exchange between the Russian and Belarussian registers, comparability of the data and increase of statistical power of the incorporated researches.

Source of the information for formation UChR from the Russian party is - RNMDR, from the Belorussian party - BSR.

The purpose - creation and support of functioning uniform of medical and dosimetric databanks for realization joint large-scale of radiative - epidemiological researches and forecasting of medical consequences of accident on Chernobyl atomic power station in territory of Russia and Belarus.

In figure 1 the statistical substantiation of necessity of creation UChR is graphically submitted. Dependence of statistical power of research of radiation risks here is shown from a dose and number of cancer diseases revealed after the ending of the latent period. On an horizontal axis the average total dose of an irradiation is postponed which was received by the inhabitants polluted radionuclides of territories about density of pollution more than 185 kBq/m^2 for 20 years after accident on Chernobyl atomic power station. On an vertical axis – general number revealed of cancer diseases for 10 years after ending the latent period (as is known prospective latent period for solid cancer makes 10 years). From figure it is visible, that the general number of cases of the cancer revealed for the period 1996-2005 in polluted territories Bryansk areas (a total dose makes about 20-25 mSv) is below than area signify of radiation risks. But if to the Russian data to add the similar data on the polluted areas of the Gomel area, already from 2006-2008 volumes saved in UChR of the data allows to expect for reception statistically signify of estimations radiation risks.

Figure 1: Statistical power of an estimation radiating is brave in Uniform Chernobyl register of Russia and Belarus



The works on creation UChR were carried out on 4 directions.

1. Development of the advanced uniform protocols of information interchange.
2. Tax and analysis of the personal data in cases possible radiation - induced pathology (formation specialized subregisters: thyroid cancer, breast cancer, leukemia, subregister of the liquidators, cancer - register of the liquidators, subregister children of the liquidators).
3. Development and filling of databases.
4. Development of a program complex UChR.

The formation UChR provided use of a some of the primary documents available in the registers by each of the countries - participant, and also additional sources both personal, and

generalized information. For creation UChR such primary documents were base which well have recommended themselves at long-term functioning, and also are close enough among themselves in both countries: a medical card of the out-patient patient, notice on the patient with for the first time in life by the established diagnosis of a cancer or other malignant tumor, extract from a medical card of the stationary patient and others. The present primary documents are applied both in territory of Russia and in territory of Republic Belarus. On the basis of these documents the format of a database for information interchange between the registers of Russia and Republic Belarus was generated. Each of such primary documents is characterized in the certain parameters, which control during activity of the registers and provides quality of the data and level of their verification. Except for of the personal information system UChR includes the developed in addition databanks (DB): demographic DB, medical-statistical DB, radioecological DB.

3. Results

During performance of works above formation UChR the territories Belarus and Russia included in «a zone of interests» UChR (Figure 2) were determined. First of all (1 level of supervision) is Bryansk area of Russia (especially its southwest areas with density of pollution on ^{137}Cs more than 185 kBq/m^2) and Gomel area of Belarus (especially it east and southern areas, where density of pollution on ^{137}Cs also exceeds 185 kBq/m^2). Area of research - radiation risks of cancer diseases of various localization at the population of the most polluted territories. The following level of supervision are the Kaluga, Tula and Oryol area of Russia, and five stayed areas Belarus, basic area of research – thyroid cancer among the population polluted radionuclides of iodine of territories. The third level of supervision is all territory of Russia and Belarus. Area of research - medical consequences for health of the liquidators, their children and persons, migration from the polluted territories.

Figure 2: Territory of supervision of the Uniform Chernobyl register



In view of the allocated levels of supervision are created and the following subregisters function: the subregister of thyroid cancer, which includes the information about verification cases of thyroid cancer among the population of Republic Belarus and Bryansk, Kaluga, Tula areas of Russia, the information is brought in for the period 1982 – 2006 years; the subregisters of breast cancer and leukemia contains the information on cases of disease by a breast cancer and leukemia among the population of the Gomel area of Belarus and Bryansk area of Russia, the subregisters of the liquidators and children of the liquidators contain the personal information on the persons who were taking part in liquidation of consequences of accident on Chernobyl atomic power station and their children, subregister of cancer diseases among the liquidators of Belarus and Russia. Work on creation of the

uniform cancer - register of the population living in territories with density of pollution on Cs¹³⁷ more than 185 kBq/m² (tables 1) now will be carried out.

Table 1: Information structure of personal subregisters of the Uniform Chernobyl register

THE NAME SUBREGISTERS	TERRITORIES of SUPERVISION	QUANTITY OF CASES	YEAR of CREATION
THYROID CANCER	Republic of Belarus	13375	1998
	Bryansk, Kaluga, Tula and Oryol areas of Russia	7065	
LEUKEMIA	Gomel area	2996	1999
	Bryansk area	2238	
BREAST CANCER	Gomel area	8416	2002
	Bryansk area	8263	
LIQUIDATORS	Republic of Belarus	94 798	2003
	Russian Federation	157 086	
CANCER – REGISTER of the LIQUIDATORS	Republic of Belarus	40049	2004
	Russian Federation	2 833	
CHILDREN of the LIQUIDATORS	Republic of Belarus	8 722	2005
	Russian Federation	26 701	
Cancer - register of the population living in territories with density of pollution on Cs ¹³⁷ more than 185 kBq/m ²	Gomel area Bryansk area	11407 Is created	2007

The situation was facilitated by that to the moment of a beginning of works on creation UChR the most part necessary of the personal information, both with Russian, and from the Belarussian party was already entered into the computer in different formats of a storage, that has allowed quickly enough to generate uniform formats and to exchange the information on their basis. Besides, presence in Republic Belarus of the Belarussian cancer-register, functioning since 1973, essentially has facilitated procedure of the tax and verification of cancer diseases among the injured of the population Belarus.

For the tax and the transfers of the information on each of subregisters were developed the advanced uniform protocols of information interchange between RNMDR and BSR («The protocol of information interchange between RNMDR and BSR with the revealed diagnoses leukemia, thyroid cancer or breast cancer for formation of the Uniform register of Russia and Belarus»), allowing to carry out the tax and updating given UChR on registration, medical and dosimetric, demographic information, and also radiation - induced pathologies on the basis of uniform technology and unified forms.

The basic methodical approaches to quality surveillance of a material and its verification were developed. The procedure of the verification control includes a line of consecutive medical - organizational measures.

The system of the analysis of the epidemiological information UChR is intended for account and analysis of the basic characteristics (number of cases, parameters incidence, its structures, distribution of these sizes on territories, on age on the moment of disease, dynamics of required parameters). The development of the software on to the radiative – epidemiological analysis of the data UChR was carried out with the purposes of unification of the approaches and techniques used in the Russian and Belarussian branches UChR.

Now is developed and the program complex «UNIFORM CHERNOBYL REGISTER is tested: a subsystem of the analysis of the radiation - unduced pathologies at the inhabitants of the Gomel and Bryansk areas » (figure 3).

Figure 3: A kind of the screen in the beginning of work of the program



The basic task of a program complex is the account of the characteristics used at realization of the radiative - epidemiological analysis of incidence of the inhabitants of the Gomel and Bryansk areas.

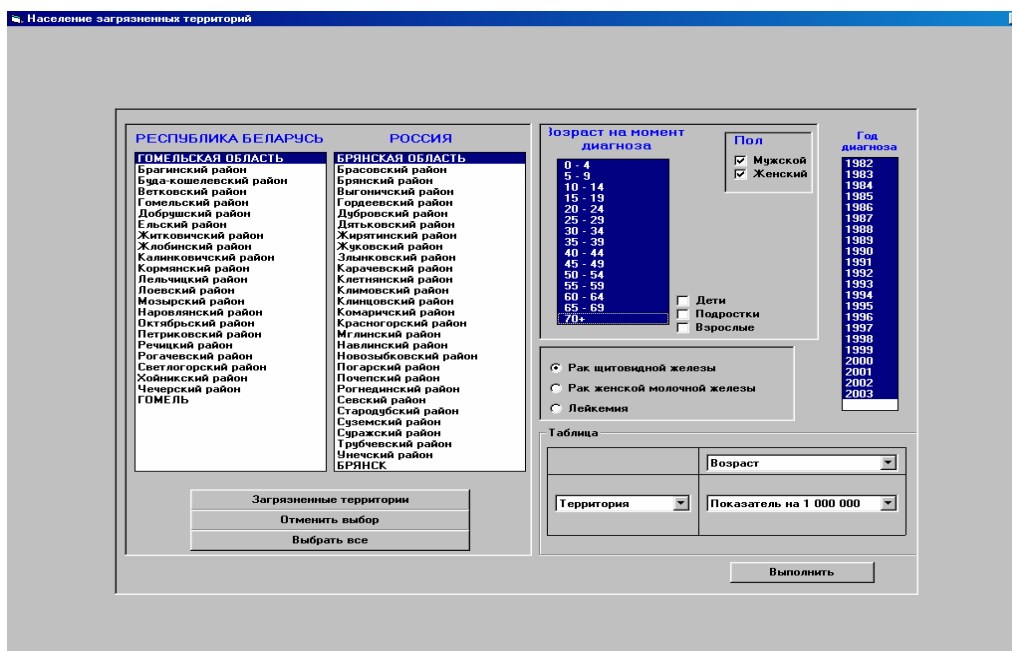
Now program complex allows to calculate the following characteristics analyzed of cohorts:

- number of cases of disease
- number of person -years under risk
- a rough parameter incidence (in recalculation on 1 000 000 man)
- the standardized parameter of incidence (is used the World standard).

The developed software allows to carry out in an interactive mode the analysis basic of the epidemiological characteristics of quota of the UChR. The system has two basic subsystems "Cartography" and «The tables and diagrams». The names of subsystems display the form of representation of results the analyses of the epidemiological information in cartographical, tabulated and graphic kinds accordingly. For today a subsystem "Cartography" is in a stage of completion.

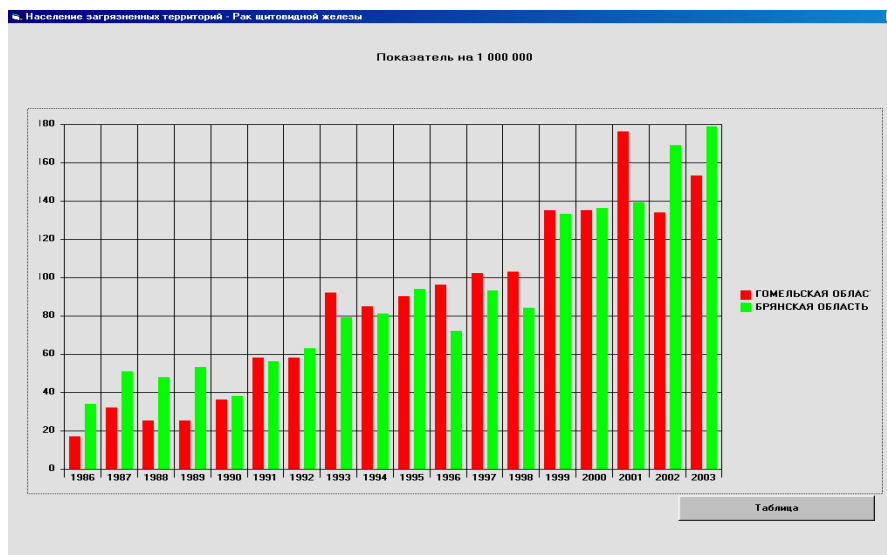
The interface of the user is executed in OS Windows-standard and is organized as removable of windows controlled by mouse. At the analysis of the radiation - unduced pathologies revealed among the population, the regional level of residing is accessible. In case of a breast cancer or leukemia - all areas of the Gomel and Bryansk areas. In case of a thyroid cancer - all administrative areas of Belarus and four Russian areas: Bryansk, Kaluga, Oryol, Tula. The ambassador creation of inquiry by a choice of the required characteristics and parameters from the fixed list (figure 4) and reception of results of inquiry the management is transferred in the block of display of results are the interactive diagrams (column of the diagram and linear diagrams) and tables, constructed on their basis, which can be exported (to keep) in a format of spreadsheets or textual documents.

Figure 4: Formation of cohort of the population of the polluted territories for the subsequent analysis



If at formation of inquiry in windows "Year" was specified more than two years, it is possible to look dynamics of required parameter. In a mode of viewing of dynamics it is obviously possible to change a type of the diagram on linear and on the contrary (figures 5-6).

Figure 5: Representation of dynamics of incidence as column of the diagram

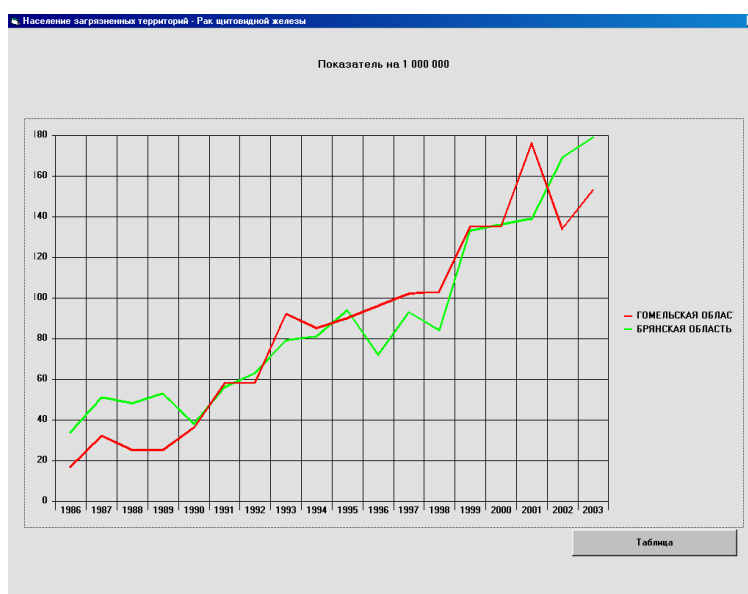


The error messages or incorrect actions of the user are generated or as the preventions, or is direct by an environment OS Windows.

The system functions on the standard personal computer in Russian to operational system Microsoft Windows 98/2000/NT/XP.

With use of means Access is limited and the access to the information in BD is supervised. Control system of databases supports differentiation of access to the data at a level of the users. The various users BD can have a various level of access to the data.

Figure 6: Representation of dynamics of incidence as the linear diagram



Thus, the work of system of the analysis of the epidemiological information UChR is enough idle time convenient, intuitively clear and does not require of the user of special preparation in the field of computer science and epidemiology.

Also, for optimization of work and, taking into account different legal base in two states, the works on preparation and statement of the uniform document regulating work UChR were carried out. In 2004 the uniform document «A Rule about the Uniform Chernobyl register of Russia and Belarus» was accepted.

Now UChR provides:

- information support at development of the administrative decisions by bodies of the executive authority of Russian Federation and Republic Belarus on minimization of medical consequences of accident on Chernobyl atomic power station and increase of efficiency of medical aid to the citizens of The Federal State of Russia and Belarus undergone to radiating influence;
- creation and support of functioning of medical and dosimetric databanks on medical consequences of accident on Chernobyl atomic power station in territory of The Federal State of Russia and Belarus;
- realization joint large-scale of radiative - epidemiological researches by an estimation of dosimetric dependence and forecasting of medical consequences for the irradiated citizens of The Federal State of Russia and Belarus.

Thus, due to fruitful joint work of the Russian and Belarussian experts for one years, past from the moment of a beginning of works on creation of the Uniform Chernobyl Register of Russia and Belarus the following basic works are executed:

- the uniform protocols of an exchange personal and population by the data between RNMDR by the register and BSR are developed;
- the incorporated databases of the Uniform register containing the personal information in cases of diseases, revealed in before and after the emergency periods are created;
- the incorporated databank of the medical-demographic information is created;
- the program-software on statistical and radiative - epidemiological to the analysis of the data is created. The system of the analysis of the epidemiological information of the UChR is enough idle time convenient, intuitively clear and does not require of the user of special preparation in the field of computer science and epidemiology.

During 2007-2010 years continuing to support functioning before the created registers, the works on creation are planned:

- of the subregister on noncancer incidence and mortality among the liquidators.
- of the subregister of progeny of the liquidators of the second generation.

The development of system of the UChR will allow to continue performance of such urgent scientific - practical works as:

- definition of groups of the increased radiation risk among the population of Russia and Belarus, undergone to radiating influence (liquidators, their children, population most polluted radionuclides of territories),
- creation of mathematical models for an estimation and forecasting of radiation risks of cancer and noncancer diseases after Chernobyl accident,
- development of the practical recommendations on preventive maintenance, treatment and rehabilitation of the population of Russia and Belarus, undergone to radiating influence.

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