This publication is issued by
The Institute of Democratic Politics (Lithuania)
In cooperation with
National Endowment for Democracy (USA)

Editor
Prof. Yury Bandazhevsky

Dailininkas *Algimantas Dapšys*
Dizainerė *Nijolė Juozapaitienė*

Išleido leidykla „Eugrimas“, Kalvarijų g. 98-42, LT-08211 Vilnius
Tel./faks. (8~5) 273 39 55, info@eugrimas.lt, www.eugrimas.lt
Spausdino Uždaroji dizaino ir leidybos AB „Kopa“, Kampo g. 7, LT-50153 Kaunas
www.kopa.eu

ISBN 978-9955-790-37-2

Contents

Foreword 7

José Bové. The most important in brief 9

Prof. Yury Bandazhevsky. Radiation, Ecology and Health of People, Foundation of the Ecology and Health Research Centre 12

Prof. Ivan Nikitchenko. Economic, Social, and Demographic Consequences of the Chernobyl Catastrophe for Belarus 22

Prof. Danutė Marčiulionienė. Radioecological Situation in Lithuania after the Chernobyl Catastrophe (1993–2007) 26

Prof. Laurent Gerbaud. Nuclear Energy and Health Care 33

Dr. Galina Bandazheuskaya. Level of Health of Disaster Fighters and Victims of the Accident at Chernobyl Nuclear Power Plant 36

Valentina Smolnikova. Level of Health of Child and Adult Population Residing in the Territory Polluted by Radioactive Elements (Buda-Koshelevo District, Gomel Region, the Republic of Belarus) 49

Alexei Duzhy, Elena Bulova. Lower Limb Amputations as a Reflection of Severity of Cardiovascular System Lesion among the Population Living in the Territory Polluted by Radioactive Elements (Petrikov District, Gomel Region, Belarus) 54

Prof. Frédérick Lemarchand, **Prof. Gilles-Eric Séralini**. Project for an Institute for Sustainable Environment in Normandy 60

Prof. Gilles-Eric Séralini. France Risk Assessment for GMO and Associated Pesticides: The Case of GM Maize MON 863 66

Alexander Volchanin. Social and Economic Problems of Disaster Fighters Involved in Elimination of the Accident at Chernobyl NPP in the Republic of Belarus 69

Bénédicte Belgacem, Prof. Dave Sheehan. Perspective of Creation an International Syndicate of Liquidators of Accident in Chernobyl Nuclear Power Plant 73

Jean-François Rivalain. International Humanitarian Initiatives in Support of Democracy and Rendering of Assistance to People who Suffered from the Accident in Chernobyl Nuclear Power Plant in the Republic of Belarus 76

Dr. Yegor Fedyushin. On Prospects of Building a NPP in the Republic of Belarus 80

Prof. Georgiy Lepin. Chernobyl – the End of Shagreen Leather 85

Prof. Georgiy Lepin. A Nuclear Power Plant in Belarus – Promises vs. Reality 91

Yuri Voronezhtsev. Uncompensated Risks of the Byelorussian NPP 96

Foreword

The issues of health protection of the population exposed to one of the strongest anthropogenic factors – radiation – should be of prime importance for the activities of the international community. The accident at Chernobyl nuclear power plant in 1986 resulted not only in considerable property and health damage caused to the affected countries and nations, but also demonstrated just how dangerous an irresponsible attitude to the issue of radiation use can be. However, we have to admit that the Chernobyl catastrophe provided an opportunity to study the effects of the radiation factor on human and animal bodies and obtain data of considerable scientific and practical significance.

For the Belarusian people, the Chernobyl catastrophe has become a real tragedy in every sense of the word. Huge rise in incidence rates leading to increasing mortality and decreasing birth rate among the population determines the current demographic situation in Belarus which is one step apart from a catastrophe. Rescue of the Belarusian nation requires fundamental changes in political and economic activities not only by the Belarusian government, but also by the international community. Scientists and public figures representing, first and foremost, medical and ecological areas have to pronounce on the issue of activating these processes. We need to combine their efforts within a movement aiming at protecting public health. In this respect, it is relevant to speak of establishing **a Chernobyl initiatives network in general, and in the form of a network of international researchers and organizations working on the problem of the effect caused by radiation agents on the human body and elimination of consequences**

of the Chernobyl catastrophe in particular. Consolidation of scientists and public figures within such a network will allow coordinating their activities to ensure the acquisition of unbiased scientific information on effects of radiation and other external environmental factors on the human body which, among others, may be reached in the course of scientific research, dissemination of this information among the world public and governmental agencies, development of proposals, and performance of specific health protection measures.

Scientific and Humanitarian Initiatives in Support of Chernobyl Disaster Fighters and Victim, an international scientific and practical conference to be held in Vilnius on October 9, 2008, will also work towards achieving this goal.

Materials presented for the conference by its participants in the form of speech theses testify to considerable interest taken by the international scientific and humanitarian public in the problems of health of people exposed to the radiation factor, as well as desire to help change the current situation for the better.

I would like to express my hope that this conference will become one of the consecutive stages in consolidation of scientific and humanitarian forces with the aim of providing efficient assistance to the people affected by radiation as a result of the Chernobyl catastrophe by the international community.

Prof. Yury Bandazhevsky

The Most Important in Brief

José Bové, *President of the Institute of social and ecological alternatives (Institut pour des alternatives sociales et écologiques),* FRANCE

It is not a question of whether a nuclear catastrophe will happen – it is a question of when it will happen and what region it will devastate. By exploding twenty years ago, Chernobyl power unit reminded us that this form of producing energy is the most dangerous one. At present time, irresponsible politicians and unscrupulous industrialists try to make the nuclear energy look like a way out under the circumstances of global warming caused by the greenhouse effect. We need to act against such judgment in full force, and to begin with, let us consider some facts.

In France, nuclear energy is presented as being cheaper than electric energy. This statement by nuclear energy producers is no more than an advertising slogan, a deception engineered by their PR departments. There is a huge cost behind the nuclear power plants – a cost which is never taken into consideration and rarely brought to light.

Diffusive environmental pollution is one of the most pernicious consequences of such situation. Samples taken in France this summer showed that ground waters near nuclear power plants are polluted. The residents are drinking polluted water. This state of affairs has been known to political leaders for a long time, but they've kept quiet about it and concealed it from people living close to NPPs. From the very beginning, the civil nuclear lobby has been hiding under a veil of secrecy serving short-term financial interests. All this is supported by government authorities.

The cost of this diffusive pollution is never reflected in the price of electric energy. Dismantling a nuclear power plant which has come to the end of its service life is an undertaking worthy of Dante's pen: dangerous, extremely expensive, and almost never

implemented. Out of a hundred nuclear power stations which have served their time only five have been partially dismantled, while the rest have just been stopped. Ugly piles of iron and concrete, for which apparently no one is responsible, are all what's left of those NPPs. It is absolutely reckless and even criminal to use energy which is presented to us as cheap while leaving our children and grandchildren with a dilemma of finding technical and financial solutions to compensate for the damage caused.

Chernobyl has shown us that the nuclear nightmare can cause extensive harm. As a result of the reactor's explosion, 300,000 hectares were devastated and polluted, and two cities were completely abandoned. The number of deaths related to Chernobyl remains a carefully guarded secret. According to official UN data, 47 deaths caused by the Chernobyl accident have been registered. Unfortunately, the reality is quite different. Independent research, such as the one performed by Professor Bandazhevsky, has identified a huge rise in the incidence of cancerous diseases in the areas most heavily affected by radioactive fallout. This translates to tens of thousands of people whose premature and painful deaths were caused by Chernobyl nuclear power plant.

Nuclear technologies are extremely dangerous and have an effect on the human society. A state making a choice in favour of this type of energy has to take measures to protect the stations from external and internal interventions – such as a foreign army or a group of fanatics – and ensure information security. The state machine has to reckon with it and put on the uniform of public safety servants. From now on, it has to watch its own citizens as well as representatives of other nations. It has to ensure constant military anti-air defence on its own territory. Simply put, it now lives in constant fear. The very concept of personal freedom is irrelevant in such societies, and I am deeply convinced that, besides sanitary risks and harm caused to the environment, one more extremely dangerous NPP factor lies in creation of dictator societies with a destructive nature.

Lack of transparency in these countries and their multilateral instances only serve to prove my case. The law of silence imposed by them shows an urgent need for an expert examination and in-

dependent research of financial capabilities and military power. Professor Bandazhevsky has paid a high price for his search for the truth, spending for years in prison. The sentence term shows not so much the desire to silence or punish a doctor who presents the data collected by him in an unfavourable light as the desire of the nuclear lobby to get rid of any forms of disagreement with the established order.

We should welcome the initiative by Yury Bandazhevsky to establish an institute for research of sanitary consequences of technological solutions. We need to support such actions since they are aimed at the same goals that we pursue in other materials – for instance, those related to biotechnologies. Similarly to nuclear power plants, transgenic research is appropriated by companies and countries claiming to be fervent judges. Without independent and financially uninterested research we will never be able to choose our future as the citizens of the planet and knowingly assume responsibility for technical solutions. The myth about positive technology has perished in Ukraine.

To drive the final nail in the coffin of nuclear power plants, I believe it is necessary to expose the connection existing between the so-called "peaceful atom" and nuclear weapons. Enormous pressure exerted by the international community on such countries as Iran or North Korea emphasizes the fact that all leaders perfectly understand that nuclear energy used for peaceful purposes almost always transforms into military nuclear independence. The spread of nuclear power plants will inevitably result in the spread of the nuclear threat and resumption of tension between the countries in different corners of the world.

All these and other arguments make me an ardent opponent of nuclear energy. The meeting organized in early October in Vilnius will become an important milestone. It will allow us to support those men and women, those disaster fighters who were cynically sent right in the centre of destruction in Chernobyl. It is very important that even after twenty years after this tragedy those who suffered most from the horrible catastrophe are finally given the right to know the truth. And let us gather enough courage to learn the lessons of the past in order to avert the potentially ominous future.

Radiation, Ecology and Health of People, Foundation of the Ecology and Health Research Centre

Prof. ***Yury Bandazhevsky,*** *BELARUS*

Radio-ecological problem

The ecological environment influencing health of people regulates the development of human society. Despite considerable progress in protecting the environment and therefore health of people, there are countries with serious environmental problems. First of all these are the countries of the former Soviet Union. The desire to catch up with and overtake the Western countries in military and economic development compelled the leaders of the former Soviet Union to introduce the industrial technologies causing pernicious impact on the environment and therefore on people's health. First of all nuclear weapon tests conducted by the USSR should be taken into consideration.

Pollution by radioactive elements of huge territories of Belarus, Lithuania, Latvia, Estonia, Ukraine, and Russia which started in the sixties of the 20th century is a consequence of such activities. The population of these countries had no information on the existing radiating factor, and, naturally, had no way to protect itself from its influence. Starting with the sixties, a large content of ^{137}Cs radionuclides was observed in foodstuffs consumed by the residents of the above-mentioned countries for many years (Marey, A.N. et al., 1974; Rusyaev, A.P. et al., 1974; Ternov, V.I. & Gurskaya, N.V., 1974). (Fig.1)

Cow milk is one of the basic products forming rather high levels of ^{137}Cs radionuclides content in residents of Belarus and Baltic lands. A "Milk-Caesium Map" was created, which shows that largest ^{137}Cs radionuclides content was observed from 1967 to 1970 in Gomel region of the Republic of Belarus (Fig.2).

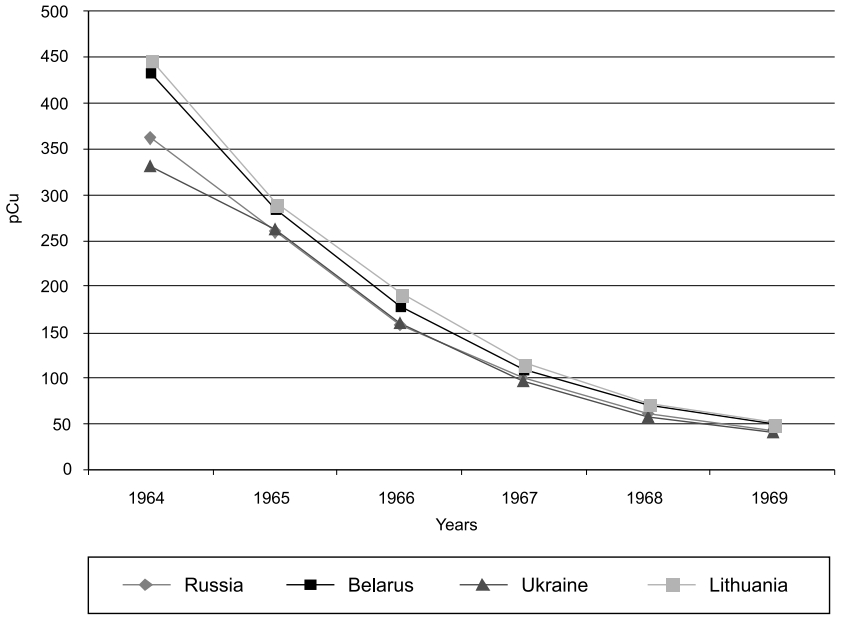


Fig.1. ^{137}Cs contents in villagers' daily food allowance in pCurie (Marey, A.N. et al., 1974).

The Chernobyl accident of 1986 considerably intensified the already existing radiation effects on the population of some European countries and first of all the Republic of Belarus.

The map of ^{137}Cs radionuclides deposition in the territory of Belarus after the Chernobyl accident in 1992 (Fig.3) almost corresponds to the map of such radionuclides deposition in the territory of Belarus in the sixties published in 1974 (Marey, A.N. et al., 1974.).

Only after the Chernobyl accident of 1986 owing to actions taken by Western public organizations it became possible to speak about the influence of radiation agents on the health of people in Belarus and other countries.

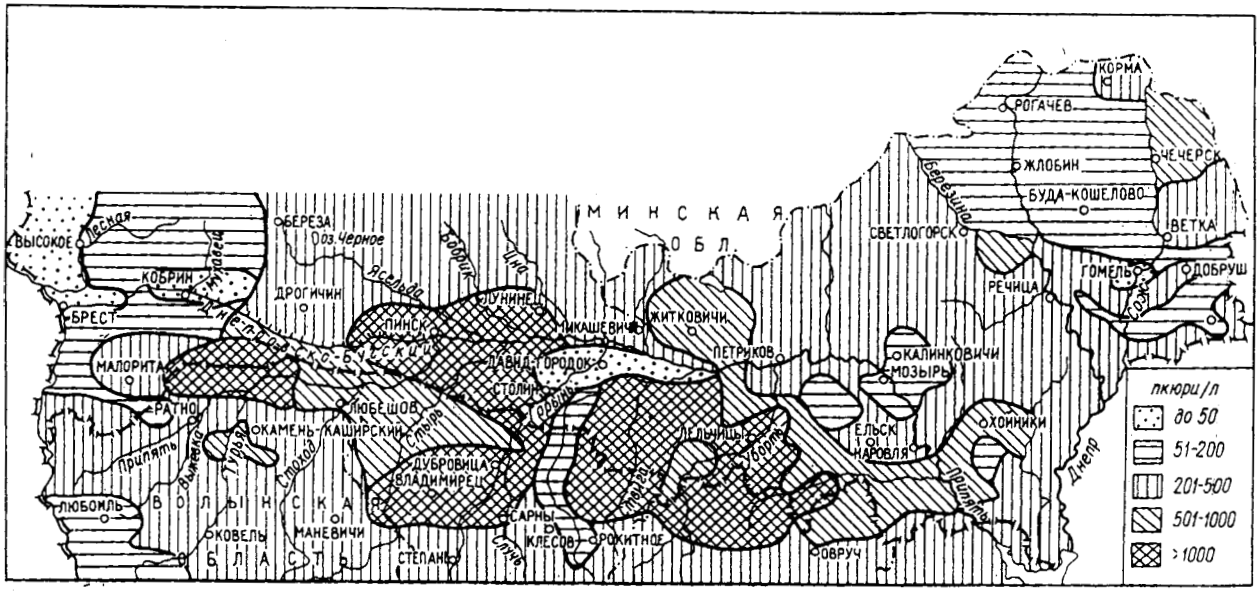


Fig.2. ^{137}Cs contents in cow milk in different districts of Belarus in the sixties of the 20th century (Marey, A.N. et al., 1974).

Fig.3. Map of ^{137}Cs deposition in the territory of Belarus in 1992.

The demographic problem and people's health

Starting with the sixties of the 20th century, the death rate in the Republic of Belarus has been constantly increasing, while the birth rate has been decreasing (Fig.4).

As a consequence, the demographic index (difference between the birth rate and the death rate) has been negative since 1994, and namely it amounted to -5,5% in 2003 and -5.2% in 2005 (Fig.5).

The duration of life of both men and women in the Republic of Belarus is decreasing in comparison with such western countries as France (Fig.6).

The high death rate of the population is largely related to cardiovascular pathologies and malignant neoplasms. Their steady increase can be observed every year. The decrease in the birth rate

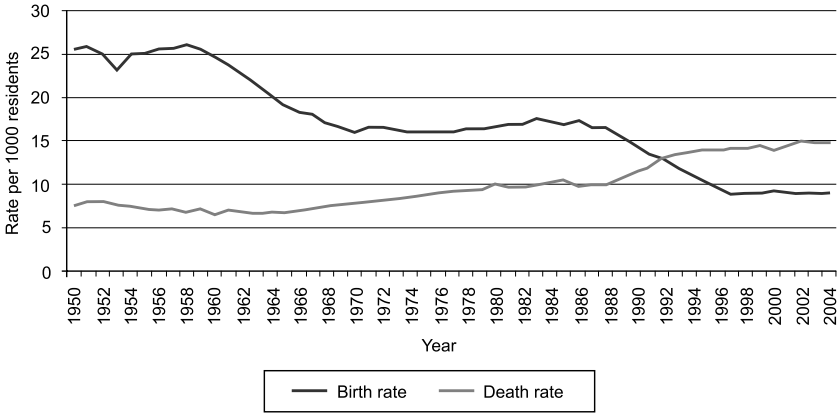


Fig.4. Death rate and birth rate (per 1,000 inhabitants) in the Republic of Belarus.

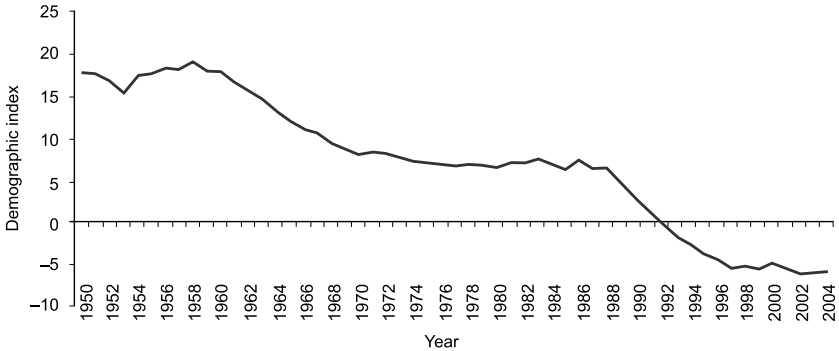


Fig.5. Demographic index in the Republic of Belarus**.**

is caused by male and female reproductive system disorders and intrauterine development pathologies.

The incidence rates in the countries of the former USSR drastically differ for the worse from such rates in the Western countries (Fig.7–8).

It has been determined that ^{137}Cs radionuclides incorporated into the human organism have negative effect on the state of its vitally important systems, primarily on cardiovascular, endocrine, reproduc-

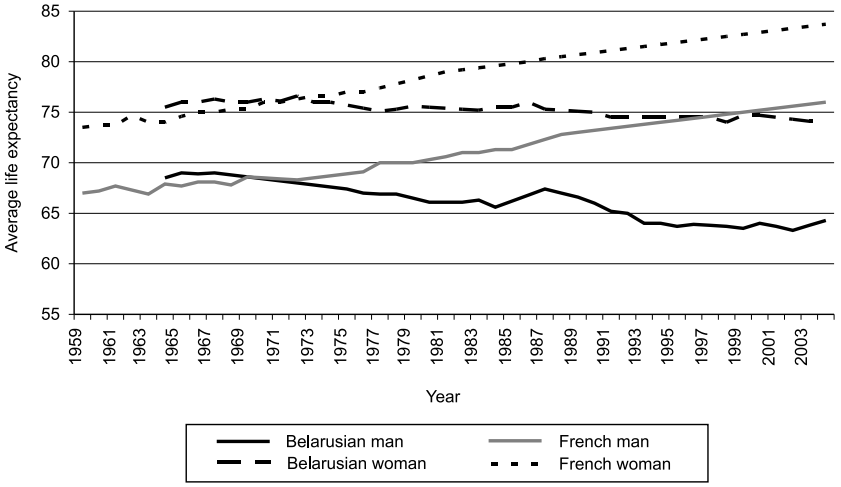


Fig.6. Life expectancy of men and women in Belarus compared to France.

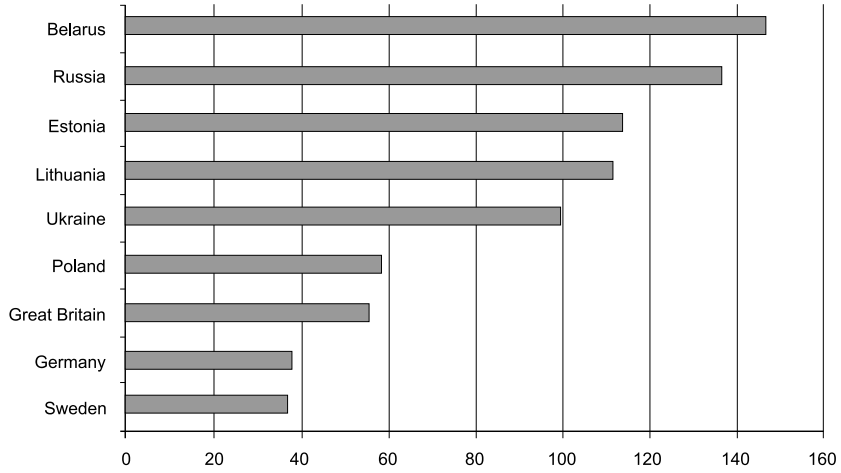


Fig.7. Ischemic heart disease rate in Europe per 100 thousand inhabitants in 1993-1994. (Population Health in Europe, 1995)

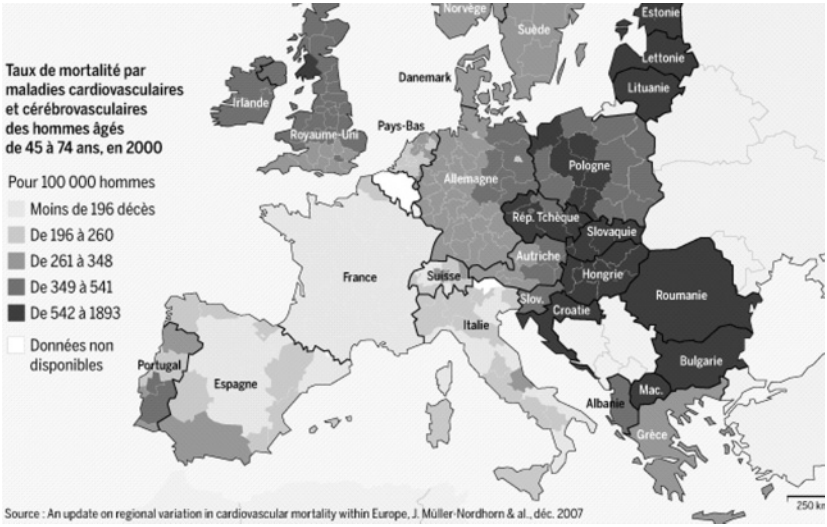


Fig.8. Death rate among male population as a consequence of cardiovascular diseases in the countries of the European Union («Les maladies Cardio-vasculaires en Europe», *Le Monde,* 03.03.2008).

tive, digestive, urinary and immune systems, organs of sight, and intrauterine development of the embryo (Bandazhevsky, Yu.I. et al., 1995–2003).

The greatest danger primarily lies in consumption of foodstuffs containing radioactive elements, and first of all – ^{137}Cs.

We have valid grounds to view ^{137}Cs as:

1) a source of mutation processes in the body during the element's decay,
2) a factor destroying the regulatory processes in the body and facilitating the emergence of pathologic processes and diseases based on the latent genetic predisposition;
3) a toxicant causing lesion of vital organs in large concentrations due to the destruction of the cell energy apparatus.

In our opinion, this constitutes the main cause of increase in the rate of many diseases on the territory of the Republic of Belarus.

The analysis of the current situation with the health of the Belarusian population indicates that a demographic catastrophe caused by prolonged exposure to radiation is developing.

Protection of public health

Unfortunately, the authorities of the Republic of Belarus ignore the problem of adverse effect of the existing radiation factor on the people's health. This is evidently confirmed by the requirements to radioactive element content in foodstuffs (PRL – Permissible Radiation Levels) adopted by the Belarusian state. These requirements facilitate the exposure of all citizens of the Republic of Belarus to radiation and the development of the above-mentioned diseases. Disregard for the problem of protection of the population from radiation is a violation of the right of every human for protection of his/her health.

A bright example of this is the attitude towards those involved in the elimination of the accident in Chernobyl Nuclear Power Plant. These people were deprived of any social support by the state.

Creation of the Ecology and Health Research Centre

The current situation with the health of the citizens of the Republic of Belarus as well as other ex-USSR countries should arouse serious concern among the world public. The situation can be resolved only with the help of the international community based on the principles of democratic cooperation. However, to adopt and implement appropriate measures aimed at minimizing the consequences of the exposure of the population of the above-mentioned countries to radiation, the international community needs unbiased scientific information and scientifically grounded proposals.

Foundation of the Ecology and Health Research Centre is one of the answers to this question.

The results of the Centre's activities would be specific suggestions on planning the development of several spheres of the national

economy, where the greatest attention will be paid to the solution of the demographic problem and people's health protection.

In order to change the current situation it is necessary to conduct comprehensive scientific research estimating all aspects of people's life. Involvement of specialists from different scientific fields for the evaluation of the current situation will allow not only diagnosing the effects of the current catastrophic situation in reproduction human resources but also determining possible solutions to the problem. It is planned to involve doctors, ecologists, economists, businessmen, and lawyers from different countries of the world and, first of all, from the European Union in this work.

Literature

1. Bandazhevsky, Yu.I. *Pathophysiology of Incorporated Radiation*, Gomel, Gomel State Medical Institute, 1997.
2. Bandazhevsky, Yu.I. *Pathology of Incorporated Radiation*, Minsk, Belarusian State Technical University, 1999.
3. Bandazhevsky, Yu.I. *Radiocaesium and the Heart (Pathophysiological Aspects)*, Minsk, Belrad, 2001.
4. Bandazhevsky, Yu.I. *Pathological Processes in the Body during Incorporation of Radionuclides*, Minsk, Belrad, 2002.
5. Bandazhevsky, Yu.I, "Cs-137 Incorporation in Children's Organs", *Swiss. Med. Weekly*, No. 133, 2003, pp. 488–490.
6. Bandazhevsky, Yu.I. et al., *Clinical and Experimental Aspects of Effect of Incorporated Radionuclides on the Body*, Gomel, 1995.
7. Bandazhevsky, Yu.I. et al., *Structural and Functional Effects of Radionucludes Incorporated in the Body*, Gomel, 1997.
8. Bandajevsky, Y.I. & Bandajevskaya G., "Cardimyopathies au Ńesium 137", *CARDINALE* (Paris), XV, 2003, No. 8, pp. 40–42.
9. Bandazhevsky, Yu.I. *Medical and Biological Effects of Radiocesium Incorporated into the Human Organism*, Minsk, 2000.
10. Marey, A.N. et al., *Global Cs-137 Fallout and the Human*, Moscow, Atomizdat, 1974.
11. Population Health in Europe. Report on Monitoring Measures to Obtain Health for Everyone in 1993–1994. Regional VOZ Publications, European Edition, No. 56, Copenhagen, 1995.
12. Public Health Service in the Republic of Belarus. Official Statistics Digest. Minsk, 2006.

13. Public Health Service and Medical Science in Belarus. Statistics of the Ministry for Public Health Service of the Republic of Belarus. December 1, 2006. Access mode: <http://stat.med/by>.
14. Rusyaev, A.P. et al., "Strontium-90 and Caesium-137 Content in the Principal Foodstuffs of the Population of Belarus", in *Occupational Hygiene and Population Health*, Minsk, 1974, pp. 22–26.
15. Shevchuk, V. E. & Gurachevsky, V.L. (eds.), "20 years after the Chernobyl accident. Consequences in the Republic of Belarus and their overcoming", in *National report of the Committee for the problems of consequences of the accident at the Chernobyl NPP of the Council of Ministers of the Republic of Belaru*s, Minsk, 2006.
16. Ternov, V.I. & Gurskaya, N.V., "Radioactive fallout on the territory of Minsk in 1963–1970", in *Occupational Hygiene and Population Health*, Minsk, 1974, pp. 20–22.

Economic, Social, and Demographic Consequences of the Chernobyl Catastrophe for Belarus

Prof. ***Ivan Nikitchenko,*** *Corresponding Member of the National Academy of Sciences of Belarus*

Belarus was the country to suffer most from the effect of the Chernobyl catastrophe. The experts estimated that about 70 percent of radioactive discharges fell out on its territory. As a result, one fifth of the country's territory with over 2.3 million people residing on it was polluted with ^{137}Cs, not to name other radioactive elements. The economic damage was assessed at over $30 billion. The territory was divided into four zones by pollution levels according to the concept of safe residence of population under polluted conditions developed by the Academy of Sciences and approved by the Council of Ministers of Byelorussian Soviet Socialist Republic in 1990. These zones were: the mandatory resettlement zone (concentration of ^{137}Cs – 40 and more Cu/km^2, ^{90}Sr – 3 Cu/km^2, plutonium – 0.1 Cu/km^2): the resettlement zone: (15–40 Cu/km^2, 2–3 Cu/km^2, 0.05–0,1 Cu/km^2, respectively); the zone with the right of resettlement (5–15 Cu/km^2, 0.5–2 Cu/km^2, 0.01–0.05 Cu/km^2, respectively), and the zone of residence with periodic radiation monitoring (^{137}Cs – 1–5 Cu/km^2). This gradation served as a basis for the "Law on Social Security for Victims of the Chernobyl Catastrophe" passed in 1991. Another law specifying the requirements to mean annual effective dose of population exposure to radiation and measures aimed at protection of people from radiation was passed in 2001. If the dose of 0.1 mSv per year was exceeded, appropriate protective measures were to be taken.

However, the temporary permissible levels (RPL – Republican Permissible Levels) of caesium content in foodstuffs have not been

changed, and RPL-99 is still in effect. This means that the above-mentioned addendums were not implemented, and foodstuffs polluted by radioactive substances within the limits of RPL-99 virtually guarantee some dose of radiation. To make the situation worse, all this is happening in parallel with another ecological disaster caused by ill-conceived chemicalization of agricultural sector, which resulted in adding over 4.2 million tons of mineral fertilizers and over 350 tons of herbicides and pesticides to the soil.

An important role in this problem is played by anthropogenic expansion of the pollution zone of agricultural lands. In 1987, under the order issued by the State Committee for Agricultural Industry of the Byelorussian Soviet Socialist Republic and the Ministry of Bread Products (incited by the Soviet centre), about 1 million tons of polluted grain, over 1.6 million tons of skim milk polluted in excess of the Top Permissible Levels effective at the time, approximately 200 thousand tons of coniferous and grass flour harvested in the polluted zone, and over 52 thousand tons of bones obtained by slaughtering radioactive animals were used for the production of combined feeds for poultry and pigs. Polluted feed ingredients, although to a lesser degree, were also used in the subsequent years. Combined feeds prepared from these raw materials were fed to poultry at all poultry factories and to pigs at industrial complexes. In accordance with the procedure adopted at the time, peat-dung components (which naturally contained radionuclides) were prepared at poultry factories and pig complexes. Radionuclides found their way to the soil through these components. This way, almost entire Belarus was turned into a radioactive pollution zone.

Today citizens may receive a certain dose of radiation through polluted foodstuffs regardless of where they live. This statement is corroborated by the results of research performed by an independent radiation safety institute (Belrad) as well as by our own research. For instance, examination of the pupils of the boarding school for gifted children in the town of Polotsk in Vitebsk Region showed that specific radioactivity of the bodies of many children exceeded the limit of 0.1 mSv per year. Examination of people chosen by random sampling in 8 districts of the republic (Volozhyn, Soligor and Minsk Districts of Minsk Region, Pinsk and Luninets

Districts of Brest Region, Lelchitsy District of Gomel Region, and Dribin and Gorky Districts of Mogilev Region) showed that many of them had a considerable absorbed dose of radiation. Even in Minsk a third of the examined people turned out to be carriers of radiation. During medical examinations all of them complained about various diseases.

This corroborates the data about serious radiation danger to Belarus obtained earlier by other scientific institutions (the former Institute of Radiation Medicine and Endocrinology, medical higher educational institutions in the republic, and others). The population dynamics diagram clearly shows the contribution made by radiation to the demographic catastrophe. Between 1993 and January 1, 2008 the population of Belarus decreased by 656 thousand people. Forecasts by UN experts claim that it will decrease to 9.3 million people by 2020.

However, despite all the above, the authorities do almost nothing to stop the catastrophe. Effective laws on protection of population from radiation aren't observed; moreover, they are groundlessly curtailed. For instance, the already mentioned law passed in 1991 was curtailed by more than half by two presidential decrees No. 349 and 350 in September 1995. As a result, the majority of those suffering from the effects of the catastrophe were deprived of any compensation. The Law on Regulating Certain Benefits passed in 2007 cancelled the remaining compensations almost completely. A huge number of people were left without any financial support, free medical care, benefits for housing and communal services etc. All victims of the Chernobyl accident are completely deprived of information support. The official medicine represented by its administrators does not recognize radiation as the cause of mass morbidity of the people. Resolutions on disability resulting from the Chernobyl catastrophe that were passed by medical boards before are often revoked. But the most important item on this list is the most blatant violation of constitutional rights of the catastrophe's victims.

Here is one example. Due to inactivity of state radiation protection services, a group of citizens including disabled persons, resettled persons, disaster fighters, and people living on polluted territories

decided to create the Social and Ecological Association "Centre for Support of Chernobyl Initiatives" in April 2007. Its objectives were self-defence, humanitarian aid, and public control over observance of legislation. The organization's first constitutional assembly was held in September 2007. There were at total of 51 constitutors, but due to a number of reasons (mainly the lack of funds for travelling) not all of them could come to Minsk. For this reason the Ministry of Justice refused to register the association almost half a year later. The second assembly was held in accordance with the Ministry's requirements in late March of 2008, but once again the documents were returned for revision due to insignificant reasons. After the documents were brought into compliance with the Ministry's directions, they were considered for over a month, and once again the decision was postponed on the grounds of inessential remarks. Finally, in mid-July the Ministry declined the application for registration, stating that not all constitutors were present at the assembly, although the registration sheets testified to the contrary.

Other initiatives are strangled in a similar way. Naturally, this gives rise to protests among those who suffered from the Chernobyl accident. Today these protests are still kept inside, but one day they'll build up to the point of spilling out. The consequences of this cannot be predicted. But one thing is clear: the citizens' patience is not endless, especially in the face of infinite lawlessness in the republic which has already been nicknamed "legal Chernobyl" by the people. The authorities would do well to take it into consideration.

Radioecological Situation in Lithuania after the Chernobyl Catastrophe (1993–2007)

Prof. ***Danutė Marčiulionienė,*** *Institute of Botany, Vilnius, Lithuania*

The first data on radioecological situation in Lithuania immediately after the Chernobyl catastrophe, obtained by researchers from the Institute of Physics, was represented in reports for official use only. Permission to publish this information was granted only in 1989 (Volume 14 of the collection of scientific works "Physics of the atmosphere") [3]. After that, a collection of papers from the seminar "Pollution of Lithuania by radionuclides and its consequences" was published in 1992 (in Lithuanian language) [7]. Not only did this collection contain the data on pollution on the territory of Lithuania with radionuclides after the Chernobyl accident, but also dealt with the effect of radionuclides (especially iodine) on human body, discussed various epidemiological and medical problems related to environmental pollution with radionuclides, including those of the thyroid gland, and presented the data obtained through cytogenetic research performed on Chernobyl disaster fighters.

According to V. Lujanas et al. [3], the first indications of radioactive aerosols of artificial origin entering the territory of Lithuania were discovered as early as on April 26–27 after the accident. From April 29 to May 7, increased γ-radiation dose rate levels (10–12 times on average) were registered throughout almost the entire territory of Lithuania. On some occasions in May, the highest γ-radiation dose rate levels reached 200–600 mcR/h (according to B. Butkus et al.) [3]. Thus, areas with increased ć-radiation levels of soil (the so-called "hot spots") were discovered in some areas of Lithuania in May (G. Morkūnas et al.) [3]. These data indicate the

presence of long-lived radionuclides in the soil and vegetation cover, with maximum activity levels of the said radionuclides observed on the surface. According to B. Butkus et al. [4], activity levels of ^{137}Cs in the soil after the Chernobyl accident reached 439 Bq/kg in some areas of Lithuania. According to T. Nedveckaitė et al. [3], activity levels of ^{131}I in the grass at pastures in north-eastern and central parts of Lithuania ranged from 0.5 to 2.0 kBq/kg. Iodine radionuclides migrate into the human body through the food chain and accumulate in the thyroid gland. High activity levels of ^{103}Ru were also discovered in the same areas of Lithuania. Local focuses with ^{131}I activity in the grass reaching 35 kBq/kg were observed in the southern and western parts of Lithuania. In the same areas large quantities of ^{141}Ce, ^{144}Ce, ^{134}Cs, ^{137}Cs, ^{95}Zn–^{95}Nb, and ^{140}Ra–^{140}La were discovered in the grass, foliage and conifer needles. Samples of grass, foliage and conifer needles contained "hot" particles rich in ^{103}Ru and ^{106}Ru (according to T. Nedveckaitė et al. and B. Styro et al.) [3]. Absorbed dose rates at pastures sometimes reached 700 mcR/h. Activity of ^{137}Cs in spruce needles reached 95 Bq/kg, and in some cases up to 260 Bq/kg. In the opinion of V. Filistovič and R. Jasiulionis et al. [3], forest phytocenoses, especially those of coniferous forests, constitute a more "powerful filter" for radionuclides during movement of air masses than the vegetation cover of meadows and pastures. Radionuclides from old shed conifer needles are gradually transferred to the forest floor which accumulates from 50 to 80% of radionuclides falling out with the atmospheric precipitation. The radionuclides then move from the forest floor to the soil, where main processes involving subsequent transfer of radionuclides to roots and above-ground parts of the plants will happen in the future. Mushrooms are a component of forest biocoenoses that stands out by its increased ability to accumulate radionuclides (especially ^{137}Cs). Thus, forest products (mushrooms, berries, game) containing increased amounts of radionuclides can serve as a considerable source of internal radiation of the human body.

This work presents data on activity levels of ^{137}Cs, ^{134}Cs and ^{90}Sr in indicator species of plants and soil of forest biocoenoses in Plungė, Varėna and Ignalina regions which, according to A. Gudelis [7], are located in three zones with different radionuclide pollution occur-

ring after the accident at Chernobyl NPP. Radioecological situation in Lithuania in 1993–2007 is assessed on the basis of obtained data.

Samples of three indicator species of plants (Fig.2) which are relatively widespread in forest biocoenoses and differ in various biological properties, as well as soil samples (5-cm layer) at the location of plant growth, were collected by baseline monitoring stations in three regions of Lithuania located in zones characterized by different forest floor pollution with ^{137}Cs after the Chernobyl accident (Fig.1). This figure shows the zones that generally coincide with the zones of ionizing radiation (6,5; 1,1; 0,6 μSv, respectively) affecting the thyroid gland in case of iodine radionuclides entering the human body through respiratory tracts, which existed for 10 days after the Chernobyl accident (according to R. Jasiulionis) [6]. Samples for radionuclide testing were collected in June and July of 1993 – 2007.

Activity levels of ^{137}Cs and ^{134}Cs in plant and soil samples were determined at the Institute of Physics on a γ-spectrometer with a clean germanium detector (HPGE) (Gudelis et al., 2000) and a high-energy γ-spectrometer with a semiconductor detector (Ge(L)), as well as at the Centre of Radiation Safety on a GE-1 γ-spectrometer. Radiochemical methods (published in literature by Sokolov, 1971 [2]; Pimpl, 1996 [8]; Suomela, 1993 [9]) were used to determine activity levels of ^{90}Sr in the samples. Activity levels of ^{90}Sr in the samples were measured on a UMF-1500 M low background installation and at the Institute of Geology and Geography on a Tricarb-3170TR/SL spectrometer.

Fig.2 shows data on activity levels of ^{137}Cs and ^{90}Sr in three plant species in different regions of Lithuania as well as in soil of these regions in 1993 – 2007. Data obtained by us demonstrate that the highest levels of ^{137}Cs activity in plants were found in Plungė and Varėna regions located on the territory of Lithuania which suffered the heaviest pollution with radionuclides after the Chernobyl accident (Fig.1). Among the plant species under study, Hylocomium splendens and partially Vaccinium myrtillus showed the highest capacity to accumulate this radionuclide, while Calamagrostis arundinacea was the least capable of accumulating it. This can be explained by different biological and physiological properties of the

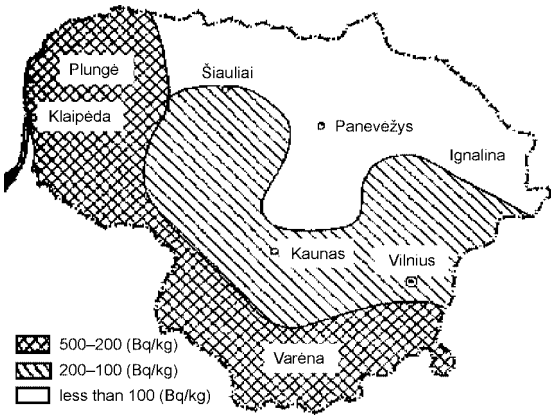


Fig.1. Locations of soil and plant sample collection in 1993–2007 in Plungė, Varėna and Ignalina regions that are located in different zones of activity levels of ^{137}Cs in the forest floor as of 1991 (according to Gudelis, 1992) [7]

plants. Activity levels of ^{137}Cs in plants (except for Vaccinium myrtillus) in all regions under study started to decrease more noticeably in 1997. The most noticeable decrease of activity levels of this radionuclide in Plungė and Varėna regions was observed only in 2002 (Fig.2). Although the lowest activity levels of ^{137}Cs in plants were observed in 2002–2007, their values varied depending both on the plant species and on the region in which the plant grew (Fig.2). The highest activity levels of ^{137}Cs both in the soil and in plants were observed in Plungė region (Fig.2). Activity levels of this radionuclide in the soil of Varėna region were lower than in Ignalina region, despite the fact that this region is located in a zone less polluted by radionuclides than Varėna region (Fig.2). This could be related not only to different soil pollution with radionuclides in the regions under study, but also to unequal amounts of mineral and organic substances in the soil. A decrease in activity levels of ^{137}Cs in the soil was observed in all regions only in 2007.

In all regions under study (but especially in Varėna region) activity levels of ^{90}Sr in plants were considerably lower than those of ^{137}Cs (Fig.2). Among the plant species under study, Vaccinium

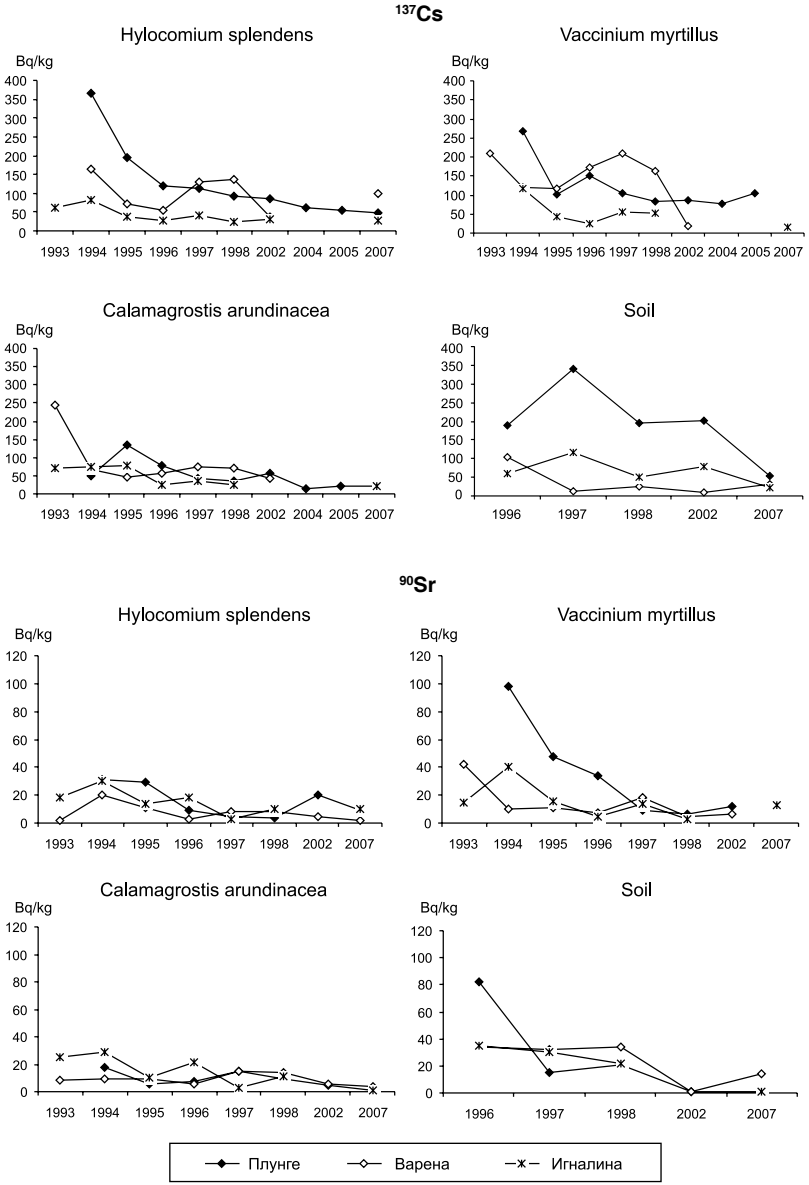


Fig. 2. ^{137}Cs and ^{90}Sr activity levels (Bq/kg of dry substance) in indicator species of plants and soil in different regions of Lithuania (1993–2007)

myrtillus in Plungė region showed somewhat increased activity levels of ^{90}Sr. Activity levels of this radionuclide in other plant species, regardless of the region they grew in, differed to a lesser extent. A decrease in activity levels of ^{90}Sr in all plant species was observed from 1997 to 2007 (Fig.2).

The highest activity levels of both ^{90}Sr and ^{137}Cs in the soil were observed in Plungė region. However, an abrupt decrease in activity levels of ^{90}Sr in the soil was observed in this region as early as in 1997, while similar decrease in activity levels of ^{137}Cs occurred only in 2007 (Fig.2). This can be explained by natural self-rehabilitation processes occurring in the soil polluted by ^{90}Sr with a much higher intensity than in the soil polluted by ^{137}Cs. When soil, especially rich in organic substances, accumulates ^{137}Cs, this radionuclide is bound stronger than ^{90}Sr. It is known that the speed of self-rehabilitation processes depends both on abiogenous and biogenous migration of radionuclides in polluted landscapes [1]. The main role in changing the flow of radionuclides from the soil to the plants is played by the process of fixation by the soil-absorption complex which determines radionuclide mobility and capability of plant root systems to assimilate them [1].

In 1994 activity levels of ^{134}Cs in plants in Plungė, Varėna and Ignalina regions were relatively low and reached 13, 6 and 4 Bq/kg, respectively. From 1995 to 1997 activity levels of ^{134}Cs in plants were gradually decreasing, and in 1998 this radionuclide was found only in Hylocomium splendens in Varėna region. From 1996 to 1997 activity levels of ^{134}Cs in all regions did not exceed 4 Bq/kg, and in 1998 this radionuclide was not found in the soil.

Data obtained by us in 1993 – 2007 shows that an improvement of radioecological state of soil and plants owing to natural self-rehabilitation processes occurred in all regions under study which were polluted by ^{137}Cs, ^{134}Cs and ^{90}Sr as a result of the Chernobyl accident. In 2007 activity levels of ^{137}Cs observed by us in the soil of Plungė, Varėna and Ignalina regions decreased on average (compared to 1996) from 340 to 55, from 103 to 30, and from 115 to 21 Bq/kg, respectively. However, they still did not reach the activity levels of this radionuclide in the soil observed on the territory of Lithuania before the Chernobyl accident. According to D. Butkus et

al. [4], activity levels of ^{137}Cs in the soil in Lithuania before the Chernobyl accident reached 4 to 8 Bq/kg on average [3].

Literature

1. *15 years of the Chernobyl catastrophe. The experience of overcoming. National report of Ukraine*. Kiev, 2001.
2. Gudelis, A. et al., "Efficiency Calibration of HPGe Detectors for Measuring Environmental Samples*", Environmental and Chemical Physics*, No. 22(3–4), 2000, pp. 117–125.
3. Jasiulionis R., „Jonizuojančiosios spinduliuotės dozės Lietuvos gyventojų skydliaukei po Černobylio atominės elektrinės avarijos", *Sveikatos aplinka*, Nr. 3, 2000, p. 42–47.
4. *Lietuvos užterštumas radionuklidais ir jo pasekmės (seminaro pranešimai)*, Vilnius, „Academia", 1992.
5. Pimpl, M., "Analytical Procedure to Determine Radionuclides in Soil", in *IAEA International Training Course on Determination of Radionuclides in Environmental Samples*, Karlsruhe, 1996.
6. Sokolova, I. *Calcium, strontium-90 and strontium in marine organisms*. Kiev, 1971.
7. Suomela, J., "Methods for Determination of Strontium-90 in Food and Environmental Samples by Cerenkov Counting", in *SSI-report No. 93-11*, Swedish Radiation Protection Institute, Stockholm. 1993.
8. *The Physics of the Atmosphere (Collection of Scientific Works)*, 14, Vilnius, Mokslas, 1989.
9. *The Physics of the Atmosphere (Collection of Scientific Works)*, 15, Vilnius, Mokslas, 1991.

Nuclear Energy and Health Care

Prof. ***Laurent Gerbaud,*** *Clermont-Ferrand University,* FRANCE

We have an urgent need to know better (or should I say to know) the sanitary consequences of the exposure to radionuclide and which policies should we implement to protect the populations. The ideological mainstream is to consider the catastrophe of Chernobyl as an isolated event. There is no proof of this. On the contrary, we can consider that the construction of new nuclear power plants in countries more or less corrupted is an increase in the risk of new major accidents. More, we also have to consider that the regular functioning of electronuclear plants produces important quantities of long life radionuclides without, today, any long-term solution for the future protection of populations. Another threat is the increasing tension in the inter-state competition, not only in relation to a context of diffusion of atomic weapons, but also considering that a terrorist attack against any nuclear power plant is easy to perform with huge consequences.

The knowledge about the long term consequences of radionuclides exposure is mainly based on two sets of data: the consequences of the atomic bombing on Hiroshima and Nagasaki, and surveys of occupational exposures, mainly civilians, in nuclear power plant or isotope and radiation medicine. Unfortunately, we have to consider that for most of the studies, the level of scientific validity is weak. Surveys of survivors of bombing began at least five years later, implying many biases (such as selection of survivor bias, inadequate assessment of the level of exposure, missing information and lost people between the bombing and the beginning of the survey…). Occupational surveys are very complex to perform when the most exposed workers are also temporary workers, which is the most

constant situation (so that they do not reach the annual authorized limits of exposure). They cannot be applied to children (who are not supposed to work, notably in a radiated area) or pregnant women. There are few surveys on the general population, although it might have been possible to find some clusters of population with a chronic exposure (such as people from the French pacific islands around Mururoa). On the whole, there are no reliable Meta analyses of data reaching the highest ranking for evidence. Sometimes we can find some literature reviews, but checking their quality we can find that they are without valid methodology and/or possibility of selection and/or publication biases. We should always be aware that, according to the rules of grading evidence commonly used nowadays, the norms of radioprotection cannot be considered as evidence based.

We must also consider that these works concern external exposure to radiation (with the important role of the barrier of the skin), while Chernobyl consequences are based on internal exposure to radiation, after intake of radionuclides mainly by foods. This is the main reason why the surveys of the contaminated population after Chernobyl cannot be exactly compared to the previous knowledge. Also, consequences may be related to the level of radiation, but we have to consider that most of the remaining radionuclides are not variants of natural elements. In consequence, we know very few about their biological cycle from ingestion (that may vary according to the food and nutriment transporting the radioactive element) to accumulation (in which organ, in which quantity, with or without saturation effect) and elimination (how, in which track, with which biological half-life…). The example of the ^{137}Cs shows a good example of our lack of knowledge: it is supposed to be a biologic equivalent to the potassium, and it seems to enter the body like potassium, to be distributed inside the organs like potassium, to enter the cells like the potassium, but if we consider the experiences provided as well by Bandazhevsky as by the French IRSN, ^{137}Cs interferes with enzymatic systems not like potassium and it stays in the cells not like potassium. We need to have correctly built cohort studies, and we have to consider that, as the main exposure is

related to foods, the measure of exposure should not be based only on the location either at one time or by computing the possible exposures related to different places of stay, but also (and sometimes mainly) by measuring the quantity of radionuclides (and most important ^{137}Cs) in the body, or better accumulated inside the organs.

We also need to know how we can wash out the bodies of contaminated people from any radionuclides. And this knowledge should extend from the capture out of the molecule to the exit from the organ and from the body. Even if Chernobyl stays a unique event, the duration of radionuclides (for instance the period or radiation half life is over 30 years for ^{137}Cs) means that we have and will have to treat hundreds of thousands of persons. We have also to take into account and to make the link with the population contaminated after nuclear bombing experimentations, such as in the French islands of the Pacific Ocean. In this particular case the existence of a postcolonial situation may produce the denial of the actual risks and health consequences for the exposed people.

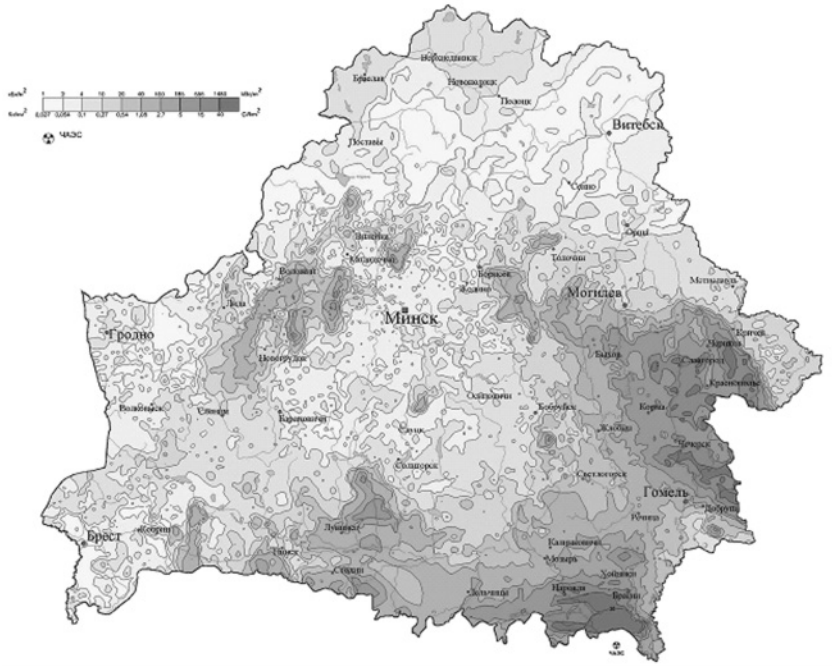
Sanitary consequences are not limited to the direct consequences of radionuclides exposure. We have to consider the social and economic aspect of any events of this kind – consequences of the panic induced decision process, moving from areas to others, uncertainty about the immediate and long-term future, collapses of incomes, social consequences of chronic threatens and illness, and so on.

That is why we have to support the building of a comprehensive programme of follow-up and assistance to the liquidators of Chernobyl. These are scientific reasons; however they are not the only ones. In my opinion, the main reason is to never forget that if in most countries of the earth we can live in a safe environment; this is due to the fact that some men accepted to take huge risks in order to stop the dispersion of radionuclides. Without them, nobody knows what would have happened. In return we must thank and support them for a very long time.

Level of Health of Disaster Fighters and Victims of the Accident at Chernobyl Nuclear Power Plant

Dr. ***Galina Bandazheuskaya,*** *Associate Professor, Researcher,* BELARUS

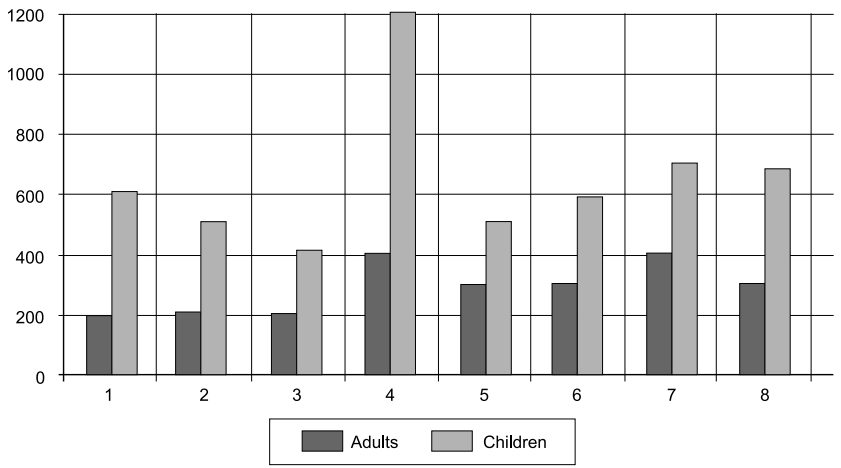
According to the scale and consequences the Chernobyl accident dating back to April 26, 1986 is considered to be the largest man-caused catastrophe in the human history. Its social, medical and ecological consequences require a detailed study. Of all European



Pollution of the territory of Belarus with ^{137}Cs as of 1986. (Shevchuk, V. E. & Gurachevsky, V.L., 2006)

countries Belarus was affected to the greatest extent. About 70% of radioactive substances released to the atmosphere as a result of the accident at the 4th power unit of Chernobyl NPP contaminated 23% of the territory of the republic. At present about 1.4 million residents including 260 thousand children live in the radiation pollution zone. The radiation situation in several affected regions is still difficult. The main danger for health comes from ^{137}Cs and ^{90}Sr radionuclides getting into residents' organisms with food. The contribution of the mentioned radionuclides to the internal dose reaches 70 to 80% (National report 20 years after the Chernobyl accident).

^{137}Cs radionuclides under conditions of permanent chronic intake by people with food are accumulated in vitally important organs: thyroid gland, heart, kidneys, spleen, cerebrum (Fig.1).



1 – myocardium, 2 – brain, 3 – liver, 4 – thyroid gland, 5 – kidneys, 6 – spleen, 7 – skeletal muscles, 8 – small intestine.

Fig.1. ^{137}Cs contents in adults' and children's viscera according to the data of radiometric measurements of the autopsies of residents of Gomel region in 1997 and 1998 (Bandazhevsky, Yu.I., 1999, 2003).

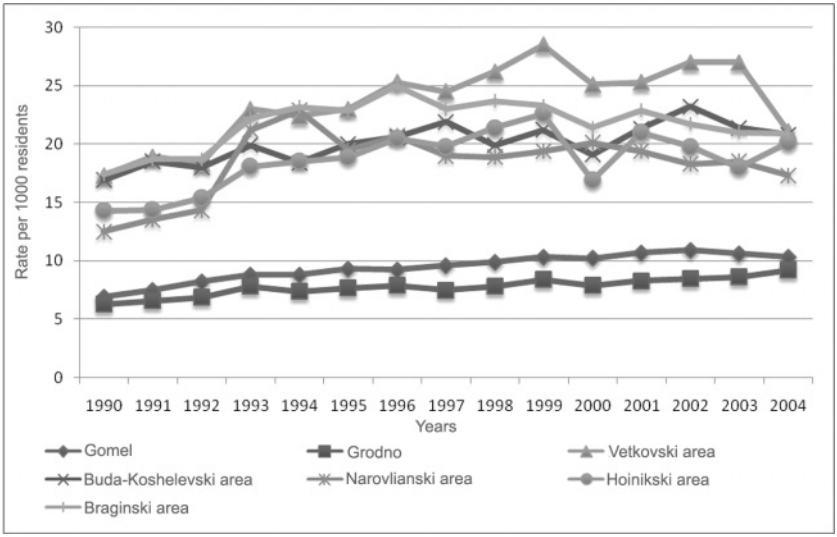


Fig.2. Dynamics of population death rate in different areas of Belarus.

The contact with radiation agents has led to doubling of the death-rate of the population in the Republic of Belarus in the last 20 years. The process of people dying in areas with a high level of territory contamination with ^{137}Cs and ^{90}Sr radionuclides is especially expressed (Fig.2).

Among the causes of death of the residents of Belarus cardiovascular and oncologic diseases take dominant place (Fig.3).

Concern is caused by significant increase of the primary incidence rates of blood circulation system diseases among the affected population (Fig.4), especially among the participants of elimination of consequences of the accident at Chernobyl Nuclear Power Plant.

It is necessary to emphasize the significant increase in the primary incidence rates of diseases characterized by increased blood pressure and myocardial ischemia, including acute myocardial infarction, and of cerebrovascular diseases among male disaster fighters in comparison with the same figures among the men belonging to other categories of the affected population (Fig.5).

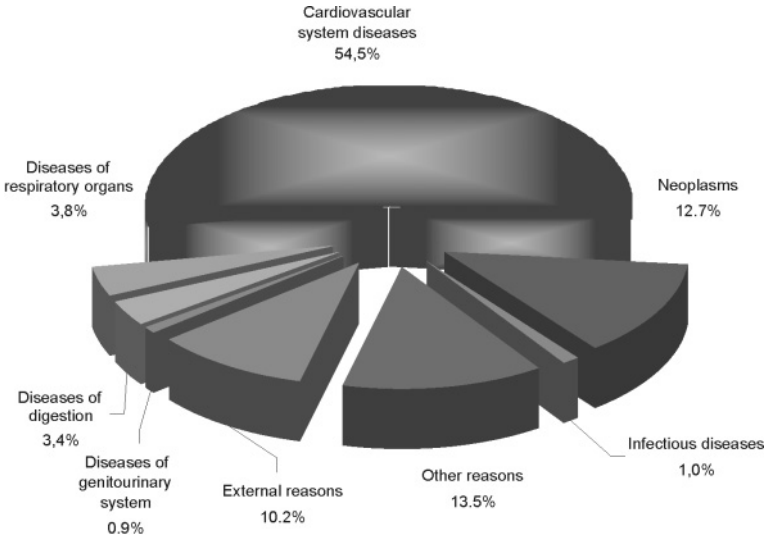


Fig.3. Structure of the causes of death in 2007 in the Republic of Belarus.

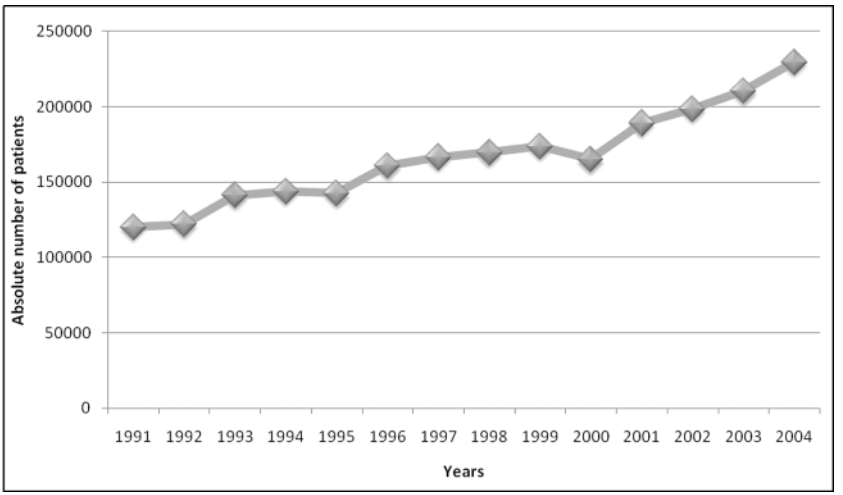


Fig.4. Dynamics of cardiovascular diseases in the Republic of Belarus.

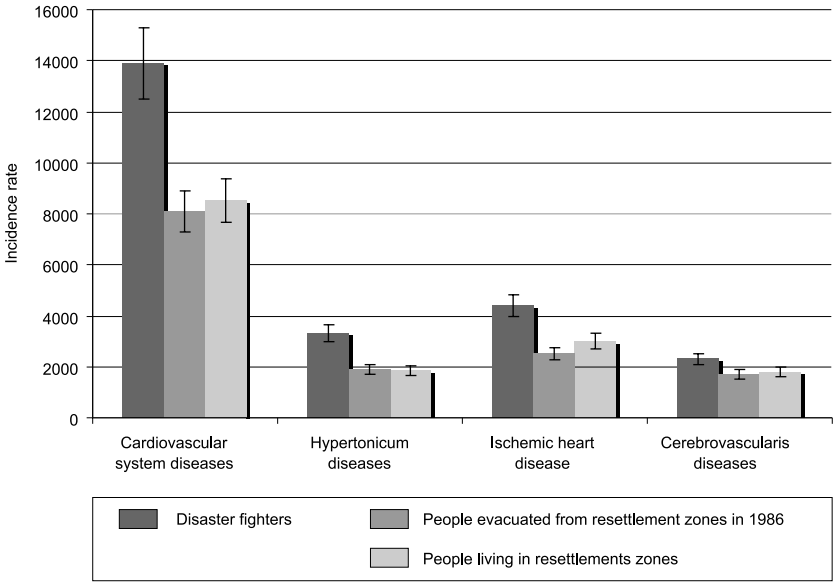


Fig.5. Standardized incidence rates of the men of the Republic of Belarus affected by the accident at the Chernobyl NPP with blood circulation system diseases.

^{137}Cs radionuclides incorporation in schoolchildren's bodies causes disorder of electrophysiological processes in cardiac muscle showing in disorder of cardiac beat rate. A defined dependence between the radionuclide content in the organism and the arrhythmia rate has been determined (Bandazhevskaya, G.S., 1994; Bandazhevski, Yu.I., Bandazhevskaya, G.S., 1995; Bandazhevski, Yu.I., 1997, 1999, 2001, 2002; Bandazhevski, Yu.I., Bandazhevskaya, G.S., 2003) (Fig.6).

During 20 years after Chernobyl the incidence rate of malignant neoplasms increased several times in the Republic of Belarus (Fig.7)

From 1986 to 2004 after the accident at the Chernobyl NPP 2,500 children fell ill with thyroid cancer with its peak in 1995 and 1996. Their sickness rate increased in 39 times in comparison with the year 1986 (Fig.8, 9)

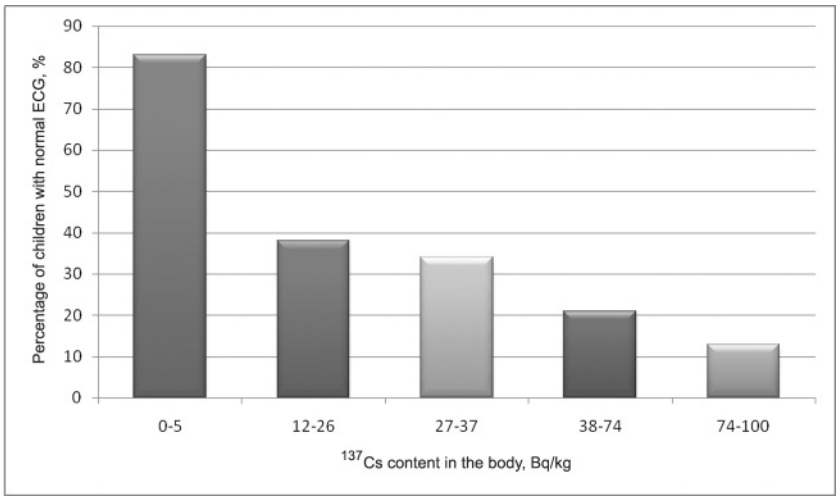


Fig.6. Number of children with normal ECG as a function of ^{137}Cs concentration in the organism.

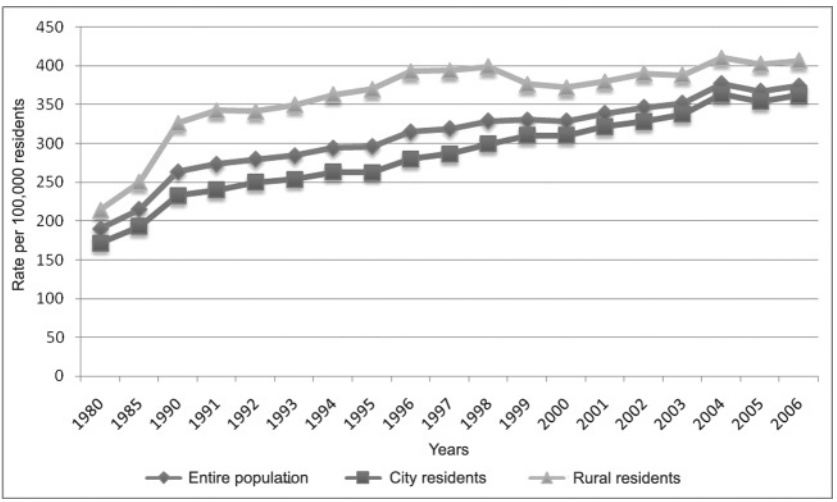


Fig.7. Incidence rate of malignant neoplasms among the population of the Republic of Belarus (per 100,000 residents).

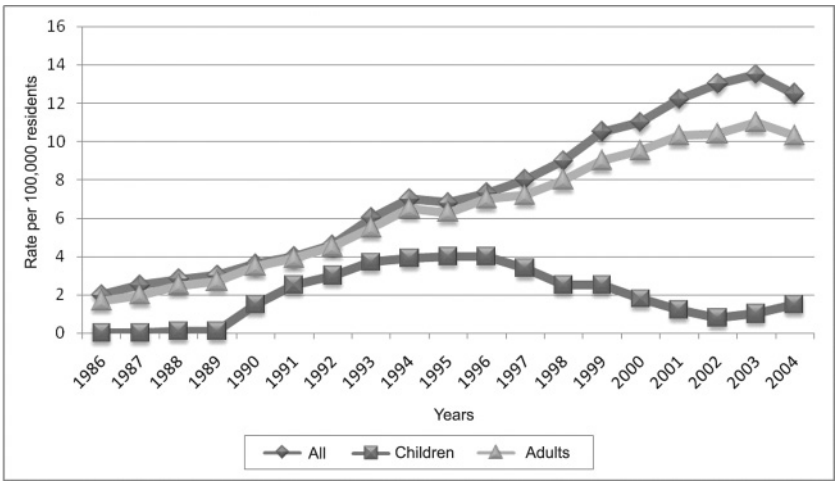


Fig.8. Dynamics of thyroid cancer incidence rate among the Belarusian population.

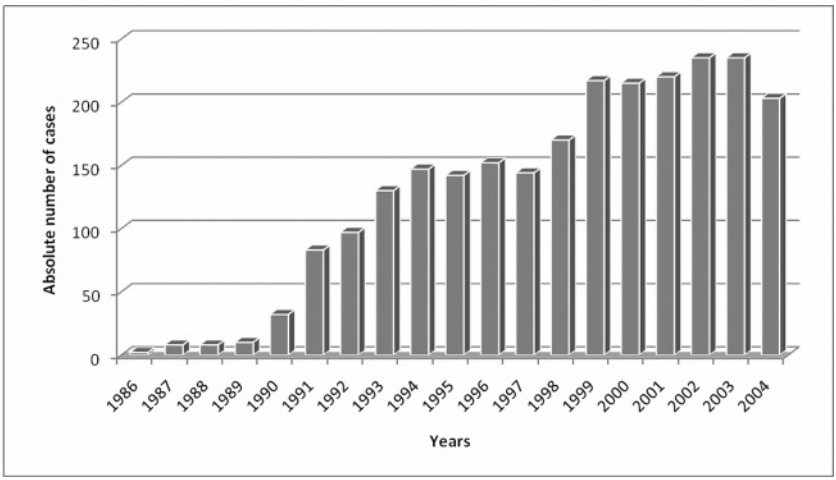


Fig.9. Dynamics of the absolute number of the cases of thyroid cancer detected for the first time.

Special mention should be given to more difficult situation with Chernobyl NPP disaster fighters who received huge external doses during elimination of consequences of the accident at Chernobyl Nuclear Power Plant and have been exposed to the continuous internal radioactive irradiation during many subsequent years.

The relative risk of the incidence rate of malignant neoplasms of all sites among the disaster fighters had begun to increase since 1997 and exceeded the value of 1.0 from 1999 to 2003 according to reliable data (Fig.10).

The rate of the increase of incidence of malignant neoplasms (including malignant neoplasms of lungs, stomach, kidneys and urinary bladder) of all sites among the disaster fighters is higher than the same figure among another groups of Belarusian residents according to reliable data (Fig.11–12).

In the territory with the density of contamination of more than 555 kBq/m^2 the average increase of the incidence of breast cancer

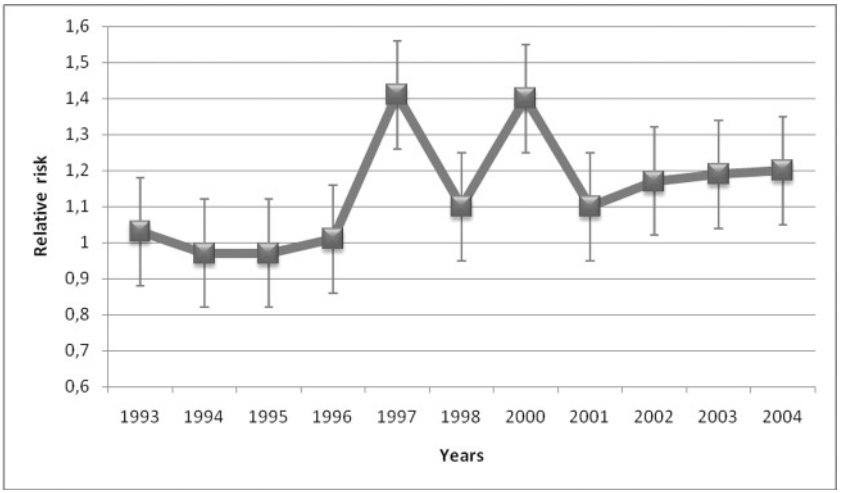


Fig.10. Dynamics of the relative risk of incidence of malignant neoplasms of all sites among the disaster fighters.

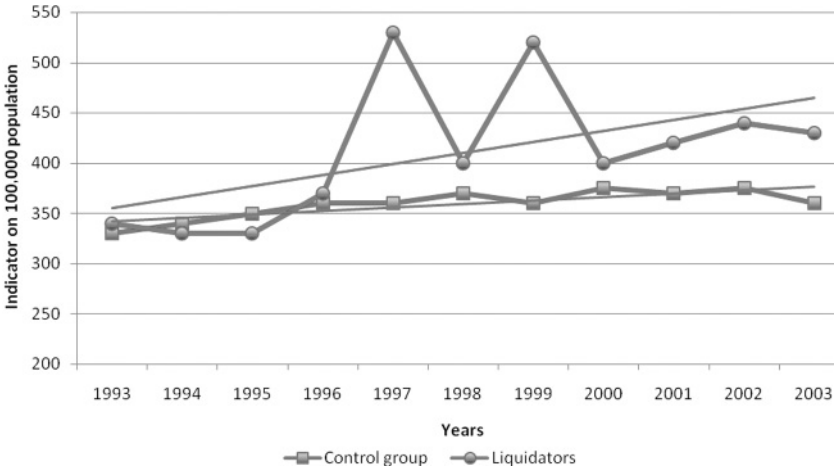


Fig.11. Dynamics of standardized incidence rate of malignant neoplasms of all sites among the disaster fighters and the population from the reference group.

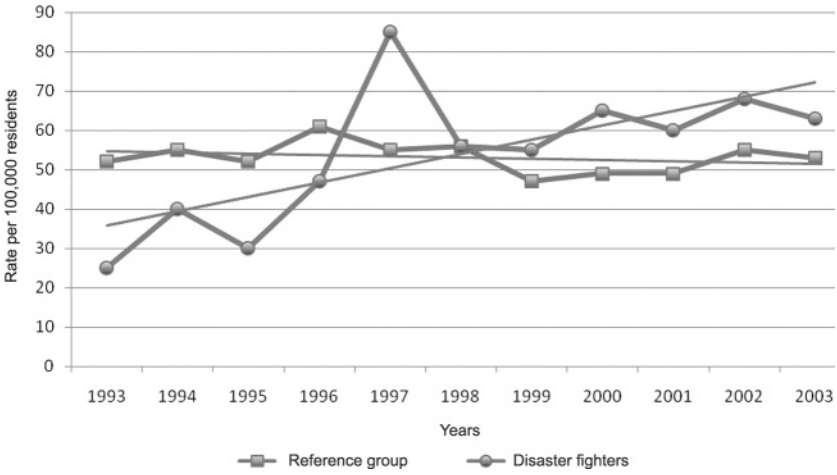


Fig.12. Dynamics of standardized incidence rate of malignant neoplasms of lungs among the disaster fighters and the reference group.

constituted 32.7% and the same time the annual average increase of the incidence of breast cancer among women from the reference group and women living on the territories with the density of ^{137}Cs contamination constituting 37–185 kBq/m^2 increased on average by 1.2% and 5.7% (Fig.13).

From 1993 to 2003 an annual increase of the incidence rate of cataract (6% on average) was detected among male Chernobyl NPP disaster fighters. According to reliable data, it is higher in comparison with the same figures among men belonging to other categories of the affected population (Fig.14).

Also worth mentioning is an increase in the number of the cases of cataract among schoolchildren living in the radiocontaminated territory. The frequency of detecting this pathology of organs of sight is in direct relation to the quantity of ^{137}Cs radionuclides in the organism (Fig.15).

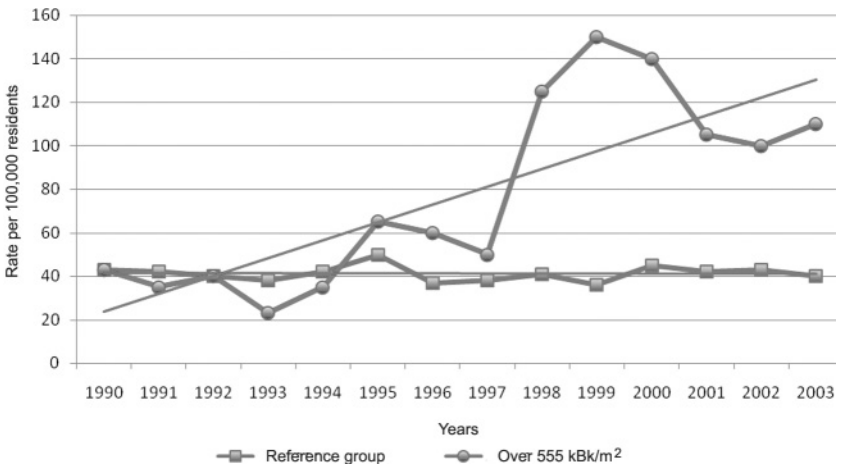


Fig.13. Dynamics of breast cancer incidence rate among women living in Gomel region on the territories with the density of ^{137}Cs contamination of 37–185 kBq/m^2, 185–555 kBq/m^2, more than 555 kBq/m^2, and in the reference group (Vitebsk region).

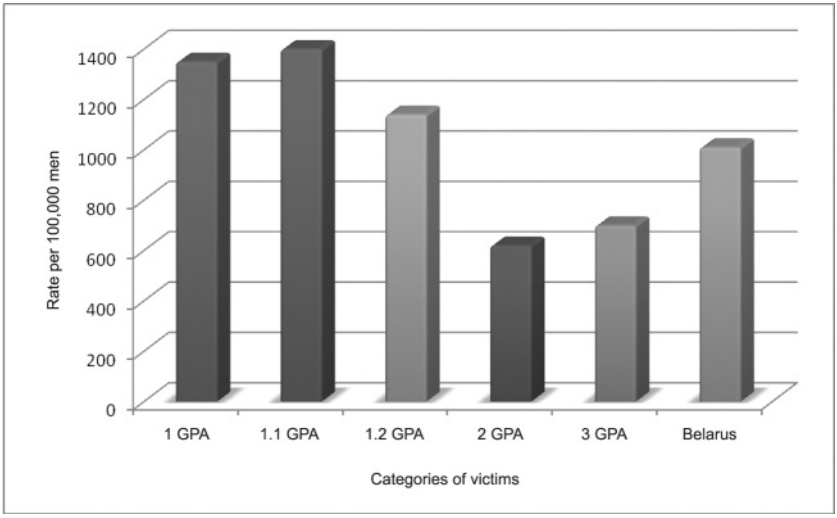


Fig.14. Incidence rate of cataract among the men affected by accident at Chernobyl Nuclear Power Plant from 1993 to 2003 (per 100,000 men).

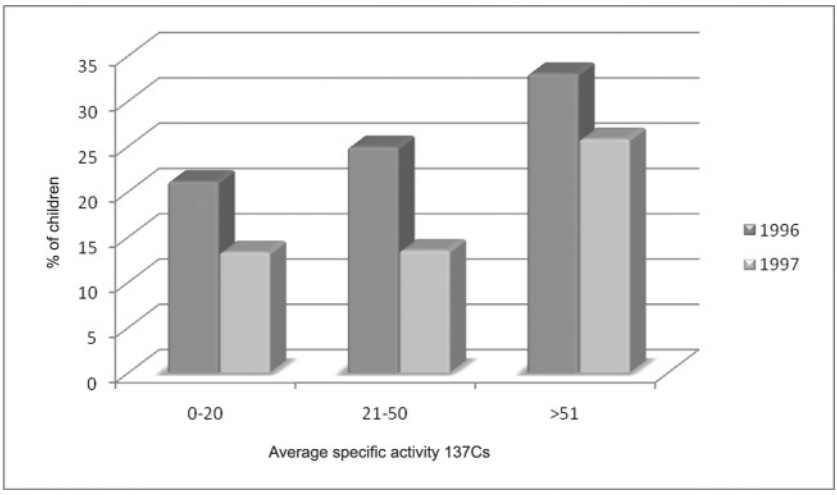


Fig.15. Dynamics of increase in the number of cases of cataract among the children of Vetka district of Gomel region depending on the level of the average specific activity of ^{137}Cs (Bq/kg) in the organism (Bandazhevsky, Yu.I. et al., 1997, 1999).

Conclusion:

1. After 22 years after the accident at Chernobyl Nuclear Power Plant the residents of the Republic of Belarus, living in the territory contaminated by radioactive elements and consuming these radionuclides with food products, run the risk of contracting cardiovascular diseases and malignant neoplasms.
2. The steady rise of this pathology within 22 years after the accident at Chernobyl Nuclear Power Plant leads to the situation that is close to a demographic catastrophe when the death-rate of the population has begun to exceed the birth-rate twice.
3. A more difficult situation takes place with the state of health of Chernobyl NPP disaster fighters that cannot but cause concern among the international community.
4. The current situation requires immediate decisions at national and international levels aimed at solving the arisen problem – protection of the state of health of the citizens living in the territories affected by the accident at Chernobyl NPP.

Literature

1. Bandazhevskaya, G.S., "Cardiac Data on Children Residing in Areas Polluted by Radionuclides", in *Medical aspects of radioactive effect on the population residing on the polluted territory after the accident at Chernobyl NPP: Materials of the international scientific symposium*. Gomel, 1994.
2. Bandazhevsky, Yu.I. *Pathophysiology of Incorporated Radiation*, Gomel, Gomel State Medical Institute, 1997.
3. Bandazhevsky, Yu.I. *Pathology of Incorporated Radiation*, Minsk, Belarusian State Technical University, 1999.
4. Bandazhevsky, Yu.I. *Radiocaesium and the Heart (Pathophysiological Aspects)*, Minsk, Belrad, 2001.
5. Bandazhevsky, Yu.I. *Pathological Processes in the Body during Incorporation of Radionuclides*, Minsk, Belrad, 2002.
6. Bandazhevsky, Yu.I, "Cs-137 Incorporation in Children's Organs", *Swiss. Med. Weekly*, No. 133, 2003, pp. 488–490.
7. Bandazhevsky, Yu.I. et al., *Clinical and experimental aspects of effect of incorporated radionuclides on the body*, Gomel, 1995.

8. Bandazhevsky, Yu.I. et al., *Structural and Functional Effects of Radionucludes Incorporated in the Body*, Gomel, 1997.
9. Bandajevsky, Yu.I. & Bandajevskaya, G., "Cardimyopathies au Cesium 137", *CARDINALE* (Paris), XV, 2003, No. 8, pp. 40–42.
10. Bandazhevsky, Yu.I. *Medicaland Biological Effects of Radiocesiumin Incorporated into the Human Organism*, Minsk, 2000.
11. Population Health in Europe. Report on Monitoring Measures to Obtain Health for Everyone in 1993–1994. Regional VOZ Publications, European Edition, No.56, Copenhagen, 1995.
12. Public Health Service in the Republic of Belarus. Official Statistics Digest. Minsk, 2006.
13. Public Health Service and Medical Science in Belarus. Statistics of the Ministry for Public Health Service of the Republic of Belarus. December 1, 2006. Access mode: <http://stat.med/by>.
14. Shevchuk, V. E. & Gurachevsky, V.L. (eds.), "20 years after the Chernobyl accident. Consequences in the Republic of Belarus and their overcoming", in *National report of the Committee for the problems of consequences of the accident at the Chernobyl NPP of the Council of Ministers of the Republic of Belaru*s, Minsk, 2006.

Level of Health of Child and Adult Population Residing in the Territory Polluted by Radioactive Elements (Buda-Koshelevo District, Gomel Region, the Republic of Belarus)

Valentina Smolnikova, *Doctor/Pediatrician,* BELARUS

During the last 15 years the welfare of Buda-Koshelevo District residents has improved considerably: the salaries at industrial and agricultural enterprises have been raised, medical care has been improved, cities and villages are better maintained, a lot of modern private and state housing are being constructed, installation of gas supply is underway, measures aimed at protecting the population from radiation are being taken. During these years not a single ecologically hazardous enterprise was built in the district. Besides, many old factories and stock-rearing farms have been closed. An increase in the population health could be expected – but, unfortunately, the statistics shows the following:

Demographic situation

Before the catastrophe at Chernobyl NPP a natural population increase (+3.2; +3.8) was observed in Buda-Koshelevo District as well as in the USSR and other European countries. Since 1991, the population size has been decreasing due to rising general mortality and falling birth rate.

The experience of Buda-Koshelevo district charitable non-government association 'Help the Children of Chernobyl' in improving the health of children residing on the territory polluted by radionuclides.

Indices	1985	1986	1996	2006	2007
District population in 1,000	51.5	49.5	44.6	39.5	38.1
Birth rate per 1,000	15.2	16.6	9.7	9.07	10.7
General mortality per 1,000	14.2	12.4	20.2	21.1	19.0
Natural increase per 1,000	+3.8	+3.4	-10.7	-11.08	-8.3

Research of primary population morbidity per 10,000 residents shows an increase in incidence of malignant diseases, cardiovascular diseases, and congenital malformations:

Disease name	1985	1986	1996	2006	2007
Malignant diseases, including thyroid gland tumour	213.7	247.0	282.0	369.3	446.7
Thyroid gland tumour	0	1.9	12.8	2.5	10.3
Acute myocardial infarction	9.2	21.1	55.3	75.9	43.9
Congenital malformations	9.8	No data	42.0	68.9	64.4

In the general morbidity structure the first place is occupied by cardiovascular diseases, unspecified cases, injuries, poisonings, suicides, oncologic diseases, and cerebrovascular diseases. The age of the deceased is rapidly becoming younger. The number of young widows and widowers is rising. A new category of biological orphans has emerged: they are children whose parents have died at young age, leaving them in care of their grandmothers. This is an unnatural situation for peaceful, quiet and problem-free life. It is known that the children's health depends of the health of their parents.

Those who were aged 1 to 10 at the time of the catastrophe, were at the intrauterine stage at that time, or were born after the catastrophe have now entered the childbearing age. Today they are adults aged above 16. What is the state of their health? 80-85% of pregnant women have diseases that complicate the gestation course: anaemia, changes in the thyroid gland, obesity, kidney diseases, arterial hypertension, and eye diseases. Only 15% of pregnant women have normal gestation course. In 2006, 25% of young men of military age in Buda-Koshelevo district had diseases preventing

them from military service, and another 30% had diseases limiting their service in the main service branches. In 2007, 84% of young men were fit for service.

Newborn children health

	2007	2006
Health group 1	147 children (37.1%)	112 persons (33.6%)
Health group 2	212 children (53.5%)	205 persons (61.6%)
Health group 3	10 persons (2.5%)	16 persons (4.8%)
Infant mortality:	9.8	21.2

Child population health groups 2003–2006 (age 1 to 14)

Health groups	2003	2006
Health group 1. Completely healthy children	46.3%	38.2%
Health group 2. Conditionally healthy children	46.4%	50.9%
Health group 3. Sick children	7.3%	12.1%

Distribution of children born from disaster fighters and migrants in 2006 by health groups:

Health group 1 – 0
Health group 2 – children with functional disorders – 359 (68.9%)
Health group 3 – children with chronic diseases – 158 (30.3%)
Health group 4 – disabled children – 4 (0.7%).

An increase in incidence rates of the following diseases has been observed among children (per 100 thousand child population):

- respiratory diseases – 63,962,
- mental derangements – 5,169,
- alimentary diseases – 5,019,
- eye diseases – 4,421,
- blood diseases – 2,327,
- urogenital system diseases – 1,063,
- musculoskeletal system diseases – 1,063,
- also sugar diabetes, immune system diseases, congenital malformations.

Disability

During the last ten years 150 to 230 adults and 14–19 children are recognized as disabled persons each year.

Child disability

The absolute figures of primary child disability have stabilized since 2002:

2001	2002	2003	2004	2005	2006
19 persons	13 persons	14 persons	20 persons	15 persons	14 persons

In 2001 there were 147 disabled children, in 2006 – 144.

Congenital malformations constituted 30% in the structure of disability in 2001. In 2006 the percentage of disabilities caused by congenital malformations already amounted to 45%, followed by nervous system diseases in the second place, musculoskeletal system diseases in the third and mental derangements in the fourth.

There is a tendency of increase in child disability caused by sugar diabetes.

As we can see, the year of 1986 has become the mark after which both the demographic situation and the population health have been degrading. In the last few years local foodstuffs have replaced radioactive environmental pollution as a source of radionuclides entering human bodies. After the Council of Ministers of the Republic of Belarus passed the Decree No. 1076 dated August 8, 2002 and Decree No. 1623 dated December 23, 2004, the legal status of many centres of population has changed, with reduction of benefits and scope of health improvement to which the children residing on the territory polluted by radionuclides are entitled.

We, the members of NGO "Help the Children of Chernobyl", started implementing the project "For the Future of the Children of Chernobyl" in 2002. The aim of the project was to identify children whose bodies had accumulated radionuclides by means of radiation monitoring with subsequent comprehensive radiation protection measures taken at every family and, if necessary, on the scale of schools and villages. We tried to encourage the population of

Buda-Koshelevo District to take an active stance on the issue of protecting the children's health from radiation.

All in all, over 2.5 thousand children were examined in 2003-2007 at the expense of foreign sponsors and local population. It turned out that 63-67% of them were born and were living in the danger area, starting from the intervention level and approaching the critical level, and required comprehensive radiation protection measures which we carried out. As a result, check measurements showed a positive effect in the form of decrease in ^{137}Cs specific activity among 43% of the children. The general condition of all children has improved. Some children returned from health improvement performed abroad "clean". Unfortunately, examinations of children carried out in 2008 before and after health improvement courses in Spain and Japan showed that the children became stronger, but specific activity of radionuclides in their bodies decreased insignificantly. Complete purification of radiation has not been achieved.

Based on the above, I can draw the following conclusions:

1. Virtually all children born and residing on the territory polluted by radionuclides who were examined within the scope of the "Radiation Monitoring" project (examinations were carried out using mobile whole-body counter chairs at BelRAD Institute and stationary units at Buda-Koshelevo and Uvarovichi polyclinics) have radionuclides in their bodies.
2. An increase in incidence rates of all disease classes (especially congenital malformations, immune system diseases, and sugar diabetes) was registered after the catastrophe.
3. To change this situation, it is necessary to provide pregnant women and children with clean foodstuffs.
4. It is urgent to review RDU-99 in terms of tightening the permissible levels.
5. Charitable organizations from Belarus as well as foreign charitable organizations contribute a lot to children's health improvement. Their experience may be needed in the future to preserve the health of the Belarusian nation.

Lower Limb Amputations as a Reflection of Severity of Cardiovascular System Lesion among the Population Living in the Territory Polluted by Radioactive Elements (Petrikov District, Gomel Region, Belarus)

Alexei Duzhy, Elena Bulova, *Petrikov Central District Hospital, Gomel State Medical University, BELARUS*

Introduction: Gomel Region of Belarus is considered to be most heavily affected by the consequences of the accident at Chernobyl NPP, since considerable part of its territory was polluted with ^{137}Cs and ^{90}Sr radionuclides. It has been shown that presence of the above-mentioned radioactive agents causes dysfunctions of many vital organs and systems leading to the occurrence of pathologic processes [1-10].

Ionizing radiation accelerates peroxidation processes in the human body, increasing the number of free radicals which cause damage to body cells (in particular, arterial vessel endothelia). This, in turn, leads to early excessive cholesterol sedimentation. Besides, ionizing radiation activates atherogenic processes by preventing cholesterol conversion to fatty acids. In the end, all this leads to early atherosclerosis and aggravates the development of angiopathies in sugar diabetes patients.

This pathologic process results in the development of stenosis, and in case of its further aggravation – occlusion and thrombosis of lower limb great vessels, impeding blood passage through the vessels and finally leading to dystrophic and atrophic processes in tissues below the level of occlusion and thrombosis. Gangrene is an extreme degree of difficult pathologic process complication directly affecting the vascular system and causing indications for immediate limb amputation. To a certain extent, the frequency of lower limb amputations related to vascular system pathologies reflects the severity of cardiovascular system lesion. This indicator, together with

the others, may be used for estimating the current health situation of residents of a particular region under the effect of the radiation factor.

Purpose of the research: to investigate the dynamics of lower limb amputations in patients suffering from obliterating atherosclerosis of lower limb vessels and sugar diabetes from 1980 to 2007 in Petrikov District (Gomel Region, Belarus) as one of the districts affected by the Chernobyl catastrophe of 1986.

Research materials and methods: we have analyzed statistical data from medical histories of 261 patients who underwent inpatient treatment at the surgery department of Petrikov Central District Hospital in the Republic of Belarus related to lower limb gangrene as complication of sugar diabetes or outcome of obliterating atherosclerosis of lower limb vessels for the period of 1980–2007. Out of 261 patients, 173 were men and 88 were women. Their average age was 69.35±6.74. Medical histories of all patients were studied retrospectively. All patients underwent lower limb amputations (at different levels) due to development of lower limb gangrene, and all of them suffered either from obliterating atherosclerosis of lower limb vessels or diabetic angiopathy (sugar diabetes type II was the most common type among diabetes patients). Surgeries due to traumatic injuries of lower limbs or repeated limb surgeries (reamputations) due to gangrene development were not considered. Age dynamics (average value) for every individual year was taken into account. Amputation dynamics was studied depending on the incidence of obliterating atherosclerosis of lower limb vessels and sugar diabetes, and also by years and age and gender groups.

Results and discussion: Negative demographic dynamics has been observed in Petrikov District since 1994 (Fig.1).

Compared to 1986, in 2007 the population decreased by 13,629 people.

Against this background, an increase in lower limb amputations is observed. We have investigated the number of lower limb amputations for every individual year, but to make the increase dynam-

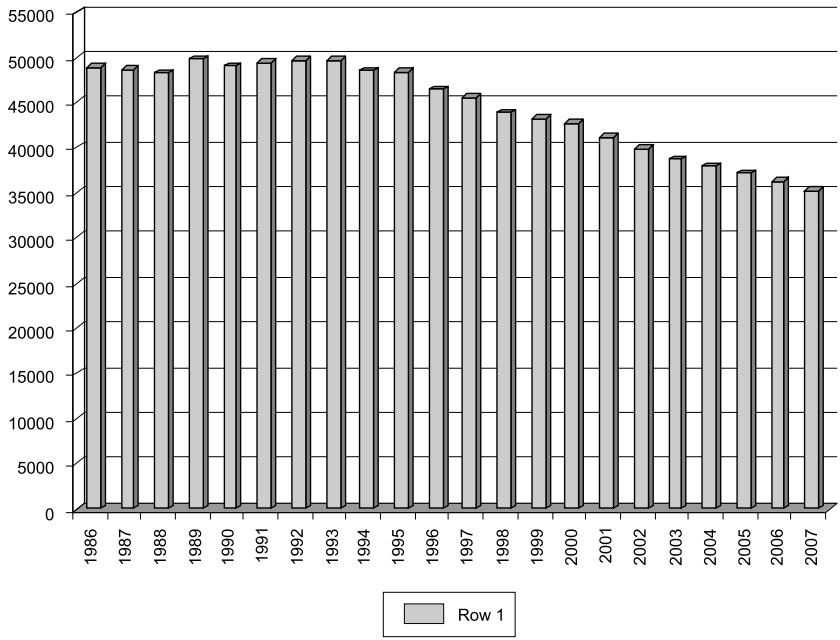


Fig.1. Population size dynamics in Petrikov District for the period of 1986–2007.

ics easier to perceive, we have also calculated an average value for 4 adjacent years (Fig.2).

An increase in these surgeries has been observed since 1991, with the first peak of amputations falling on 1995, and the second considerable rise starting in 2006.

Undulatory dynamics is observed in patient age groups, without appreciable increase or decrease in the age of patients undergoing surgery. Starting from 1991, constant presence of female patients has been recorded in the statistical data. There percentage ratio to male patients by years has an undulatory nature.

In 1991, lower limb amputations due to diabetic gangrene start to be performed (Fig.3).

An increase in amputations due to obliterating atherosclerosis of lower limb vessels and sugar diabetes is observed starting from

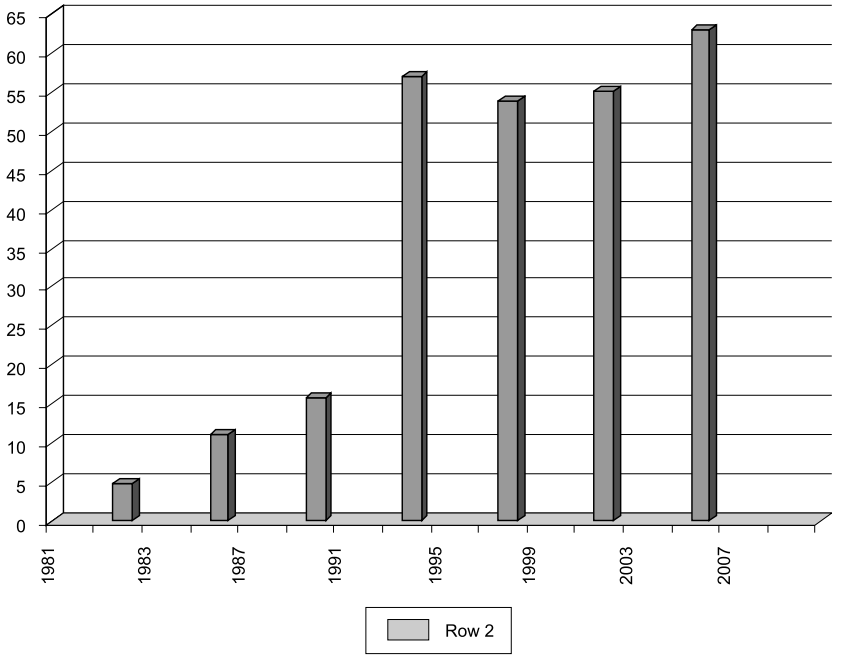


Fig.2. Lower limb amputation dynamics for the period of 1980–2007 (average value for 4 adjacent years).

1991, with the next rise of lower limb amputations due to obliterating atherosclerosis of lower limb vessels occurring in the latest years (2006–2007). The number of amputations related to sugar diabetes has remained virtually the same and even decreased somewhat since 2002.

Dynamics of lower limb obliterating atherosclerosis and sugar diabetes patients by age showed no trends of increase or decrease in the age at which surgery was performed. The average age of sugar diabetes patients was 68.015±3.61 years, while the average age of lower limb obliterating atherosclerosis patients was 69.6±4.2 years.

The dynamics diagram of patients suffering from obliterating atherosclerosis of lower limb vessels by gender groups shows an

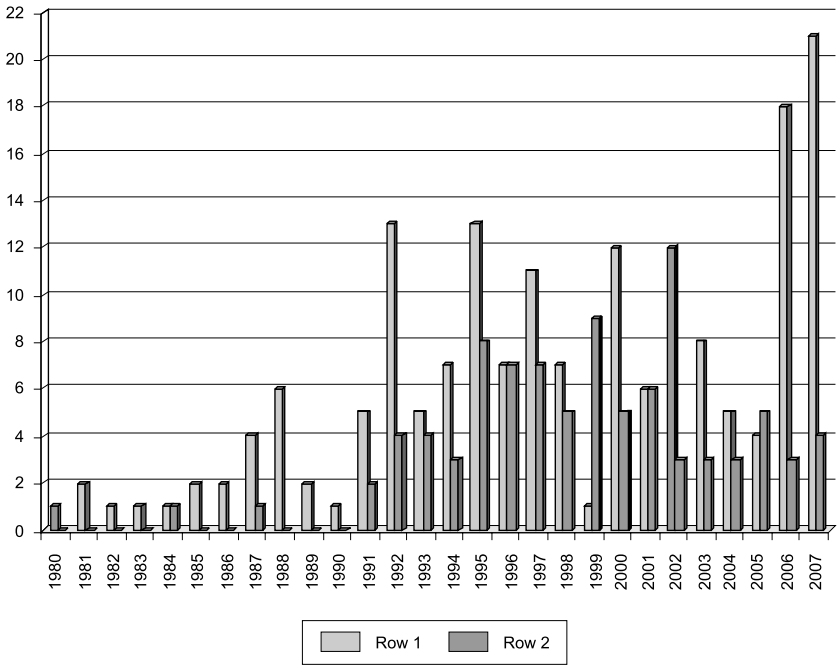


Fig.3. Incidence dynamics of lower limb obliterating atherosclerosis and sugar diabetes by years.

undulating pattern. An increase in amputations is observed starting from 1991 both for men and women. The highest number of amputations among men was recorded in 1995, 2006 and 2007, among women – in 2000 and 2007. In the last few years (since 2005), another increase in incidence among both male and female patients was observed. Amputation dynamics of sugar diabetes patients shows an increase in the incidence rate both among men and women starting from 1991, with maximum numbers recorded in 1996–1996 and 1999–2001.

The highest rate of amputations among men with this diagnosis was observed in 1997, 1999 and 2005. The number of amputations due to sugar diabetes complications among women has decreased

since 2002 and is currently stable. The number of amputations due to sugar diabetes among men shows a tendency towards increase in 2007.

Conclusions:

1. Analysis of statistical data gathered at Petrikov Central District Hospital during the period of 1980–2007 has shown an increase in surgeries related to lower limb amputations since 1991 against the background of population decrease.
2. The above-mentioned surgical interventions among the residents of Petrikov District which was polluted with radionuclides as a result of the accident at Chernobyl NPP in 1986 were necessitated by the development of lower limb obliterating atherosclerosis and sugar diabetes.

Literature

1. Bandazhevsky, Yu.I. et al., *Clinical and experimental aspects of effect of incorporated radionuclides on the body*, Gomel, 1995.
2. Bandazhevsky, Yu.I. et al., *Structural and Functional Effects of Radionucludes Incorporated in the Body*, Gomel, 1997.
3. Bandazhevsky, Yu.I. *Pathophysiology of Incorporated Radiation*, Gomel, Gomel State Medical Institute, 1997.
4. Bandazhevsky, Yu.I. *Pathology of Incorporated Radiation*, Minsk, Belarusian State Technical University, 1999.
5. Bandazhevsky, Yu.I. *Radiocaesium and the Heart (Pathophysiological Aspects)*, Minsk, Belrad, 2001.
6. Bandazhevsky, Yu.I. *Pathological Processes in the Body during Incorporation of Radionuclides*, Minsk, Belrad, 2002.
7. Bandazhevsky, Yu.I. *Pathophysiology of Incorporated radioactive emission*, Gomel, 1998.
8. Bandajevsky, Yu.I. & Bandajevskaya G., "Cardimyopathies au Cesium 137", *CARDINALE* (Paris), XV, 2003, No. 8, pp. 40–42.
9. Bandazhevsky, Yu.I, "Cs-137 Incorporation in Children's Organs", *Swiss. Med. Weekly*, No. 133, 2003, pp. 488–490.
10. Lvova, L. V., "The echo of Chernobyl", *Provisor Kharkov*, No. 10, 2001.

Project for an Institute for Sustainable Environment in Normandy

Prof. ***Frédérick Lemarchand,*** *Department of Sociology, and Prof.* ***Gilles-Eric Séralini,*** *Institute of Biology, University of Caen, France*

Recent developments in the relationships between science and society have led many researchers in Normandy to study the emerging risks. These researchers come from:

- The Institute of Fundamental and Applied Biology (IBFA)
- The Centre for Study and Research on Risks and Vulnerabilities (CERReV)
- The Interdisciplinary Risk group of the MRSH
- The Committee of Independent Research and Information on Genetic Engineering (CRIIGEN)

Thus, from a broader perspective, the University of Caen and the Normandy Region are examining the opportunity to create, for the first time in Europe, an interdisciplinary research centre for environment, health and society: the Institute for Sustainable Environment.

State of the art

From an ecological point of view, the effects of human activities on the environment and health are historically disproportionate to that which nature and man were able to produce heretofore: the introduction of thousands of new molecules – whose effects are not known – into our "environment" (the places were we live) and our air, water and food; the radical increase in global warming, which

influences agriculture, eventually influencing all the food humans consume; the exponential increase in the technical power and the human capacity to control nature (biotechnologies), the material (nuclear physics) and soon, life itself (convergence bio-nanotechnologies); the linear increase of the world energy demand in a limited resource system; the loss, linked to human activity, of biodiversity (75% of the halieutic resources of the oceans disappeared in one century, and up to 30% of all families creating a new species extinction on earth); and finally, the exponential increase of the world population in a context of depletion of resources and fragility in the underlying societal, traditional or industrial systems. Thus, we need to act urgently on these fundamental issues, in an independent way – as a global dawn for humanity – from the relevant integrated levels on a Regional, State, European and of course global basis.

The current mono-disciplinary approaches to the relationships between health and the environment or between risks and societies are inadequate, due to the limits of the established disciplines – it is important not to underestimate the wealth and the relevance of the knowledge produced by the previous disciplines. It is both the complexity of the emergence of environmental issues or risks to human and animal health, and the impossibility of managing a problem in a single-faceted approach (as in the case of biotechnologies, for example), which led numerous scientists to conclude the following: only a multidisciplinary approach (using cross-referencing) allows us to understand the true impact of environmental issues. The development of interdisciplinary learning that stems from an interaction between two or more disciplines allows the emergence of new and essential knowledge to help comprehend the complexity.

Presently, the assessment of environmental issues concerning health often creates conflict amongst scientists in various institutional research bodies (e.g. debates on GMOs, asbestos, nuclear power), and between Science and Society.

Therefore, in relation to risk management, the link between health and the environment can be considered as a complex social construction. Changing customs, practices or raising awareness require consideration at the levels defined below. It is a question of understanding the interaction between:

- the reality of the risk (of which we possess only a partial knowledge),
- the scientific knowledge which is produced (which can be contradictory, unless the theories underneath and the methods to obtain the results, and even the results themselves are clearly public and debated, which is not often the case),
- the information which is made available (by the prism of the media and the various actors participating in the provision of information),
- how this information is collated (the issue of selective sorting),
- the social perception of risk built by the population (which determines its practices).

Actors, partners and experience

1. The Institute of Fundamental and Applied Biology pioneers the development of fundamental and applied research in the field of Biology. Seven laboratories are connected to the Institute. This goes from marine and vegetal biology up to mammalian reproduction and hormonal dependent cancers. The work on the effect of pesticides on human health and cell development and death was acknowledged by the European Parliament and cited by numerous international journals. Professor Séralini's group works in particular on Roundup toxicity, the major herbicide used worldwide, and especially with edible genetically modified organisms (GMOs).
2. The Centre for Study and Research into Risks and Vulnerabilities (C.E.R.R.e.V.), ex-LASAR, was re-established by the Ministry 4 years ago. Today, the work of the C.E.R.R.e.V. is organized according to the following fields of research:
   a) The Techno-Scientific Risk in Environment and Health group, led by Frédrick Lemarchand. The group for Techno-Scientific Risk in Environment and Health received international acclaim for its work on industrial risks (AZF Toulouse, Erika, chemical and oil risks), Chernobyl, civil nuclear energy in

France, biotechnologies, asbestos, and the management of natural disasters.

b) The Health and Social Intervention group: societies, territories and public policies.
c) Policy Analysis: the crisis of institutions and the social connection.
d) Socio-anthropology of symbolism.

3. The Interdisciplinary Risk Group of the MRSH (Institute for Research into Human Sciences). The aim of the group is to improve expertise in and communication on risks through multidisciplinary knowledge, integrating the data of the physical, biological, economic and social environment. Directors: F. Lemarchand and G.E. Séralini.
   - Three principal goals are defined: examination of the means to integrate the concepts, methods and tools of the various disciplines in a global information system; the development of exchanges, even partnerships, with structures involved in the area of risk; and written research.
4. The CRIIGEN is the Committee for Independent Research and Information on Genetic Engineering. It is an apolitical and non-militant, consultation committee for expertises, independent of GMO producers. It advises on: legal, scientific (health, environment), sociological, technical (labelling – primarily into dosages of GMO), and on economic matters for citizens, companies, associations, committees and the trade unions. On a regular basis the CRIIGEN promptly handles queries on specific questions from most of the mains players in the food-processing industry and\or environmental interests, including: The Italian Ministry for Agriculture, The Quebecois Ministry for the Environment, The European Union, The Committee of Bio-Safety of China, and The European Commission Head Office for Agriculture... Recently, the CRIIGEN has published the most detailed counter-valuation of the study of health risks for an edible GMO. It does correspond to the analyses of the secret blood chemical compositions of the mammals having received GMOs in their feed for the longest time (3 months) before commercial authorization. For that, the company has lost

in Court to keep the results confidential. It demonstrated clear signs of hepatorenal toxicity (Séralini et al., Arch. Env. Contam. Toxicol, 2007).

Proposals

1. **Pluralistic or joint expertise**
   Due to the scientific controversy which systematically underlies environmental issues relating to health, it is imperative to establish a pluralistic, or joint body of expertise on risks – in an independent structure (from economics and lobbying).

2. **Independent research for reliable information**
   The Institute of Sustainable Environment will have for vocation to contribute to independent research with a multidisciplinary or transdisciplinary approach in order to better solve society problems, in particular at a health level, in a sustainable environment.

   Indeed, the establishment of standards and thresholds depends partially on the objectives and the knowledge we accumulated. This in turn and the nature of the subjects studied depend a lot on the nature of the institutions and the mechanisms of production of laws and rules, and thus on the social frame. At lower and more importantly at senior levels, civil society tends to be represented in the stakeholders which participate in the debate on sound science and its industrial applications (constituting technoscience), which develop expertise that determines activity, establishing a complex system linking the scientists, the elected representatives, the administrations, the independent or private experts, and the citizens.

3. **A competent network based in Basse-Normandie**
   The institute will set up a national and international network of laboratories and research and analysis structures, to subcontract for its own investigations and to provide a service for private individuals, local, national and international public authorities, companies, professional organizations and associations.

4. *Out* with the Pasteurian model; *in* with the integration of the human sciences

The development of efficient environmental science requires us to question the rules of the epidemiological approaches dominant at present – notably concerning the harmlessness supposed due to the weak dosages and their corollary, the establishment of thresholds. The Pasteurian model, established in the 19th century, based on the causal relationship between symptom and remedy is no longer adequate in reporting the complexity of the impacts of the environment on health. That is why it is imperative to develop multifaceted approaches (in carcinogenesis for example) integrating the contributions of human sciences (notably the qualitative data).

5. Put humanity centre stage, put service to society (citizen science) ahead of research

The concept of citizen science, introduced in France by the Citizen Science Foundation, expresses a wish shared amongst democratic states to connect the influence civil society has on decision-making in the field of scientific research and the consequent effect this has on distribution through industrial activities.

France Risk Assessment for GMO and Associated Pesticides: The Case of GM Maize MON 863

Prof. ***Gilles-Eric Séralini,*** *Institute of Biology, University of Caen,* FRANCE

CRII GEN consists of an administrative and a scientific council of approximately 20 researchers from France, Belgium and other countries, which are in favour of well-controlled GE, GMO research on efficiency, strategy and goals and for an independent analysis of evaluation. They think that tests required on environmental and health effects of GMOs before commercialization today are insufficient. The Dir. Agriculture of the European Commission, the Ministry of Environment of Quebec, the Ministry of Agriculture in Italy, the food industry such as Carrefour Group, Auchan, European Federation of Food Distribution, the University of Montreal, and Greenpeace participated in the WTO conflict on moratorium during the period of 1998–2008 among the other EU partners.

Are GMs more risky than classical hybridization? The American position is that the compositional analysis (substantial equivalence) and minor environmental trials on risks are sufficient – however, there is no traceability.

The other position is the one of Europe and 100 other countries: we need further analyses and labelling. How can we assess whether GMOs are good or bad if we don't know which foods contain them and what they do in our fields?

98% of the edible commercial GMOs are produced in northern, central and southern America. They can develop easily where there is no effective labelling, no traceability and with no long tests on the environment. There is a lot less GMOs in countries that have signed the Cartagena protocol (more than 100 countries).

There is low diversity among the GMOs today (only four products). These either tolerate or produce pesticides. The outcome is that some of the GM plants (such as Bt 176) have not been resis-

tant; they did not produce enough insecticides as they should do. 68% are herbicide tolerant. 19% produce their own insecticides. 13% produce both. Less than 1% is remaining.

Transgenic soya is herbicide tolerant; there is a possibility of accumulation of Roundup residues because of herbicide tolerance. The residues already pollute rivers. Side effects are due to the fact that pesticides are developed to be toxic. Pesticides are not reduced by GMO plants, since the plant now produces or contains high levels of pesticides. That does not make them less toxic. 99.9% are plants designed to contain pesticides that they absorb or produce. There is nothing new changing this trend on a large scale for the next coming 5–10 years.

CRII GEN has performed studies on xenobiotics as endocrine disruptors, including fungicides, herbicides, insecticides, and other pesticides.

The mixture of pesticides is dangerous. The thresholds must be given for mixtures and not for one pesticide alone. It is not sufficient because within two years the formulation of the pesticide is not tested. Thus effects on hormonal, nervous or immune system, reproduction and cancer are not well studied. This is due to lobbying by the companies.

For GMOs, the problem is substantial equivalence. The methodologies to study subchronic toxicity on rats (90 days) are not even obligatory. For new or pending GMOs: chronic toxicity tests (more than 90 days) on rats and on two other mammals should be performed, however, they are not.

Directive 2001/18 is the best in the world on paper but how are mid and long term effects on environment and health measured? Chronic tests are not even done. One month studies cannot be seriously considered long term studies. This is a scientific mistake. Animals, such as pigs, that are fed on commercial GMOs are not studied on a long term basis. Companies say that seeds can not be tested like chemicals, that it is too expensive.

There are many published effects on mammalian cells from GMOs, for example effects of Roundup GM soy, by Malatesta.

The CRII-GEN study on MON863 showed signs of toxicity in liver, and kidneys. During a 3 month study on rats a weight increase

was observed in the females and problems in liver and kidney were noticed. The male rats had even more problems in the kidney.

The study was criticized among other things because the result was presented as a mean on a curve and there wasn't a curve for each rat. Another criticism was that the curve had to be linear to the time. And yet another was that differences between male and female rats were not considered relevant. All these criticisms are not justified for CRIIGEN, even stupid.

What are the risks we are talking about?

There are risks due to the pesticides contained by GMOs.

There are also the unintended effects possibly due to metabolic disruption due the technology (insertional mutagenesis).

Expected environmental pollution due to pesticides.

Risk of irreversibility due to self-multiplying genetic and living pollution.

Patents on life: a small number of transnational companies want to own the world, food and food supplies.

All these problems are detailed in Prof. Séralini's presentations and books.

Social and Economic Problems of Disaster Fighters Involved in Elimination of the Accident at Chernobyl NPP in the Republic of Belarus

Alexander Volchanin, *Chairman of the Board of the "Chernobyl – Belarus Union" Organization*

The accident at Chernobyl NPP was the largest in the history of nuclear power engineering. Objective understanding of its economic, social, medical and psychological consequences has been the subject of many years of research conducted by specialists from different countries. 50,000,000 Cu of various radionuclides were discharged into the environment as a result of the accident at Chernobyl NPP. Due to complicated meteorological conditions after the accident, large territories of Ukraine (41.75 thousand km^2), Belarus (46.6 km^2 – while agricultural lands of the republic occupy 44.9%), and the European part of Russia (57.1 thousand km^2) were considerably affected by pollution. The trajectories of polluted air masses crossed the territories of Latvia, Estonia, Poland, Scandinavian countries, and in the south – of Moldova, Romania, Bulgaria, Greece, and Turkey. Pollution also affected the territories of Austria, Germany, Italy, Great Britain, and a number of other Western European countries.

According to official estimates by three countries (the Republic of Belarus, Russia and Ukraine), at least over 9,000,000 people were affected by the Chernobyl Catastrophe. The moral sufferings of the Byelorussian nation were expressively described by writer Svetlana Aleksiyevich in her book "The Chernobyl Prayer" – and no one can remain indifferent while reading it. A very touching recount of moral and physical sufferings was given by the pupils of Byelorussian schools in the book "The Trace of the Black Wind".

But let us turn to panhuman values. Article 1 of the Universal Declaration of Human Rights reads: "All human beings are born free

and equal in dignity and rights. They are endowed with reason and conscience and should act towards one another in a spirit of brotherhood". If the health of a German, a Byelorussia, a Russian, a Ukrainian, or a Frenchman was affected by an extraneous force, the compensations should be equal, too. Article 3 of the Universal Declaration of Human Rights reminds us that "Everyone has the right to life, liberty and security of person". The right to life presumes habitation under conditions created by nature and financial conditions created by the previous generations living on that land. This right of the Byelorussians was violated as a result of the catastrophe at Chernobyl Nuclear Power Plant: they were forced to live in conditions undermining their health and reducing their life rather than those that existed before the catastrophe. No matter how many years will pass, the day of April 26, 1986 will remain a never-healing wound in the memory of mankind. The consequences of Chernobyl are a problem that not just the Republic of Belarus should be concerned about. Today, the most important issues are the social ones, and their resolution requires joint efforts both by the CIS and the EU countries. Improvement of legislation and mutual correspondence of its underlying principles are factors necessary to fully overcome the consequences of the accident.

The scale of the catastrophe could be immeasurably larger if not for courage and dedication of hundreds of thousands of our compatriots who were involved in elimination of consequences of the accident at Chernobyl NPP. They risked their lives fulfilling their duty to protect the people from pernicious effects of radiation and its further spread to European countries.

I ask for a minute's silence in memory of those who died as a result of the catastrophe at Chernobyl NPP.

Today 108 thousand people who participated in elimination of consequences of the accident at Chernobyl NPP reside in the Republic of Belarus, plus 12 thousand disaster fighters who became disabled as a result of the accident. One million and 400 thousand

people, including 260,000 children, live in the polluted zone. In Soviet times, at least 22% of the annual budget of Belarus was spent on Chernobyl-related programmes; now, this figure is down to 6% or less.

Both governmental authorities and representatives of public organizations in the Republic of Belarus agree on one point: the largest anthropogenic catastrophe in the history of our country dealt irreparable damage to Belarus and to the health of the Byelorussian nation. But despite this, there are more disputes than agreement on other points. Chernobyl disaster fighters from Belarus are outraged by the fact that they have been deprived of the basic social guarantees (meaning cancellation of treatment at sanatoriums and resorts, the right for early retirement, additional paid vacation, and provision with medication). Participants of elimination of consequences of the Chernobyl catastrophe are indignant at refusal to admit the connection between their diseases and their stay in the radioactive pollution zone, which has become a common practice in Belarus. Today, only thyroid carcinoma is considered to be related to the accident at Chernobyl NPP.

Taking into account the above-mentioned facts, I would like to address the leaders of the European Union and the leaders of Lithuania on behalf of Byelorussian disaster fighters who took part in elimination of consequences of the accident at Chernobyl NPP, and put forth the following proposals:

- to allow visa-free travel for the participants of elimination of consequences of the accident at Chernobyl NPP;
- to increase aid provided to the Republic of Belarus by the EU countries for minimization of consequences of the accident at Chernobyl NPP with assistance of non-government organizations directly involved in Chernobyl-related issues;
- to create a Chernobyl Fund at the European Commission, with participation of Byelorussian public Chernobyl organizations;
- to establish friendly relations with the organization defending the interests of the participants of elimination of consequences of the accident at Chernobyl NPP in Lithuania.

Those who were involved in elimination of consequences of the accident at Chernobyl NPP, as well as the "Chernobyl – Belarus Union" (unregistered by the Ministry of Justice in Belarus, but granted an official registration in Ukraine), would like their suggestions to be heard from this international European tribune not only by the leaders of the European Union, but also by representatives of governmental authorities of Belarus.

Everyone living in the European Union and the CIS should be guaranteed that if they risk their lives in the interest of mankind, they will have the state's support and protection afterwards.

Perspective of Creation an International Syndicate of Liquidators of Accident in Chernobyl Nuclear Power Plant

Bénédicte Belgacem, *Health Services Hospital;*
Prof. ***Dave Sheehan,*** *Clermont Graduate School of Management, ESC* FRANCE

Today, it is difficult for us to imagine the devastating impact that both the civil and military nuclear industries have had on human beings, on our societies and on the environment as a whole. It defies the imagination when we start taking full account of the irreparable damage the Chernobyl's accident has had on our planet.

Given the high levels of toxicity of radioactivity which none of our senses can detect and given the level of risk that none of thousands of preceding generations of human beings have had to cope with even to survive; we are forced to conclude that humankind is today far from prepared to cope with such a catastrophe.

Indeed, this accident will inflict damage on many future generations of mankind to come. In our minds, we subconsciously find this irreversible situation deeply troubling, and in the end, totally revolting. In his recent work, *The Philosophy of My Life* (2006), Yury Bandazhevsky mentions the high tribute made by Soviet geneticists: more so than members of other disciplines. The thoughts that are engendered around the human genome can indeed give rise to individual unconscientious repression and to social repression.

In the end, huge financial and strategic interests are at stake in the nuclear industry. The publication and dissemination of information have been subjected to enormous pressure and censorship since the very beginnings of this industry, even in societies with democratically elected governments. The circulation of independent and objective information in this area has remained systematically and callously restricted in western societies as well as in societies

such as Belarus where tragic examples of human rights abuses have surfaced.

The war led against living beings by certain sectors of industrial society; the war led against the development of individuals and against the solidarity amongst them is being viciously and surreptitiously led by what in the end amounts to nothing more than totalitarianism whatever mask it happens to wear.

Over the past 22 years, large majorities of public opinion and governing elites have been anesthetized by a surprising and sinister convergence of "lies" propagated by the nuclear industry both from the west as well as from Soviet and post-soviet totalitarian administrations. They have not been given access to objective information concerning the gravity and the extent of the damage that the Chernobyl accident has inflicted on our lives, compromising the health and well-being of many generations of mankind in the future… They have not been in a position to imagine solutions to even begin to cope with the problem.

Dedicated people, bringing together intelligence, perseverance, and courage, have shown us the way. Yury and Galina Bandazhevsky are among them. They have dared speak out on key issues. Yury Bandazhevsky was in the forefront of scientific innovation when he discovered the impact that weak doses of radioactivity have on the human body. Many scientists have recognised the conclusions of his research and envy his accomplishments. He has always insisted that his discoveries and those of his colleagues be put to use for the benefit of mankind. Over time, and with his family, he has had to confront incredible pressure from the nuclear industries as well as from certain government officials. His activities, and those of other scientists, have led many informed individuals and associations the world over to reject these lies and to fight in favour of more open, democratic societies. The artistic works of Svetlana Alexievitch, for example, have opened up the hearts and minds of many to the sufferings of the victims of the Chernobyl catastrophe, providing encouraging examples of moral, financial and practical assistance to these victims.

To strengthen the current movement, a plan to set up an ***International Syndicate of Liquidators*** has been put forward. ("Liquidators", in Russian «ликвида́торы», is the name given in the former USSR to approximately 800,000 people who were in charge of dealing with the consequences in the aftermath of the Chernobyl disaster.)

Its objectives are threefold:

- to respect the rights of the liquidators, who have literally prevented the whole of Europe and many other areas the world over, from becoming more seriously contaminated;
- to promote access and the right of the liquidators to health care in general and to appropriate medical treatment in particular;
- to encourage and promote participation of the western medical community.

These objectives will be carried out based on the recommendations of a scientific committee whose mission will be to propose concrete, sustainable, and effective measures.

The Board of Directors consists of liquidators, i.e. those who have been contaminated by radioactivity while attempting to deal with the consequences of the accident. Acting members of the board will consist of individuals who come from countries which are members of the EU in order to facilitate the adoption of legal, financial and administrative measures on an international level.

The syndicate has in fact just been set up and we would like the international scientific community with financial and moral help from civil society to bring concrete support to the liquidators. We hope that support for the syndicate will contribute to improving a dangerous situation. We are thinking about the health of human beings and our environment, the right to carry out crucial medical research, the respect of basic human rights, the development of academic freedom and democracy.

International Humanitarian Initiatives in Support of Democracy and Rendering of Assistance to People who Suffered from the Accident in Chernobyl Nuclear Power Plant in the Republic of Belarus

Jean-François Rivalain, *Political Analyst, BELGIUM*

The question about the initiatives of the international and/or European community to support the democracy and collaterally to assist people suffering from Chernobyl consequences appears as a right scope to analyze how Western world considers Belarus.

Actually, the main evocations about Chernobyl drama happen on its anniversary days, which are the moment for reiterating the same facts and info, before the actuality sweeps out this pathos. That occasion is as well the window to condemn the current political situation in force in the main affected country, Belarus, as if these two contexts were linked.

However, a deeper analysis of the western assistance on Chernobyl contradicts the declaratory commitments of solidarity and compassion. The decade after the collapse of the USSR – which used to hinder genuine transparency on this situation, and therefore any direct assistance – the EU provided some €8 million on the most affected areas of Belarus, via its programme ECHO (European Commission Humanitarian Aid Office). The interventions focused on minimization of the sanitary effects, the medical follow-up and some cares provided by specialists. Afterwards, the Commission reminded that ECHO mandate only refers to urgency helps, which didn't correspond anymore with the Belarusian Chernobyl challenges at that time. One should nonetheless underline that such accident occurred in 1986; the urgency context, if relevant during the 90', could remain as well relevant for the years after…

On the following Belarus Action Programme 2003 defined by the EU in order *"to reduce the social consequences of the Chernobyl*

catastrophe", the aims focused on enabling local communities to deal with the day-to-day consequences of the catastrophe, including education of the population in ways to reduce harm and risks linked to radiation. For this whole year of 2003, the budget was just €6 million. Only one third – 2 million – was devoted for such *"support to reduce the consequences of the Chernobyl catastrophe",* on which one million for the nuclear safety. The 4 other millions funded programs to support institutions, education and economy.

At that time in 2003, the EU prolonged its previous ETHOS program by the CORE one, aimed at cooperating for the sustainable rehabilitation of the inhabitants in the contaminated areas. Nonetheless, over financial considerations, this program was criticized for its intrinsic board of founders and players, gathering leaders of the nuclear industry lobby: Cogema (appendix of the world n°1 Areva), and the Commissariat for the Atomic Energy etc… Fundamentally, the interest of these lobbies coincided with the Minsk regime, i.e. to minimize – if not to deny – the tough reality of the Chernobyl consequences.

The forthcoming EU Indicative Programme for 2005–2006 for Belarus remains in its quite limited budget margins: 10 million euros for these two years. Less than one third – €2.8 million – was devoted to the management of the post-Chernobyl consequences; it means a bit more than 100,000 €/month. The EU actions are spread through a wide range of projects, which minimize therefore the respective budget for each of them, but which maintain the illusion of strong and numerous involvements. All these figures and budget lines have nevertheless to be compared and appreciated by contrast with other relevant situations or realities. The GDP of the EU-15 amounted to €8,000 billion, the EU-27 one from now on around €12,000 billion. The annual EU budget is funded by €100 billion, by a marginal contribution of its member states of 1% of their national gross income. It means that the EU mobilizes for Belarus, so called "last dictatorship in Europe", "black hole" or "Cuba of Europe", therefore so called "priority of EU foreign affairs", some 0.005% of its annual budget…

By comparison and contrast, we can study the funds allocated by the EU to Serbia, as well post-communist Slavic and Russophile

country with 10 millions of citizens. The national context of Serbia was under western boycott, and then bombed. The Belarus' one is ostracized, and its means of production are depreciated. During this time, for the unique year of 2001, Serbia received €240 million as EU external assistance, and along the period 2001–2006, the EU budget for Serbia amounted to €2.3 billion. This is only from the EU side, without including the other international donors. For the whole assistance of EU to Belarus, through Chernobyl programs and others, Belarus received from 1991 to 1999, one on the lowest rates of €5.45 per capita, while Romania enjoyed €103.62 per capita. The global bill of Chernobyl for Belarus has been estimated around $235 billion.

The Commission tries to justify such minor scale of assistance, by referring to the specific political context in force in Belarus. However, the humanitarian help excludes any political or democratic prerequisite in its statutes. In case of industrial or environmental catastrophes in China or Iran, the EU would not ask these regimes to become full-fledged democracies before rescuing the civilian victims. And what about the so-called "self-isolationism" of Lukashenko's regime: on the contrary, the statements of the Belarusian officials plead towards the EU and the Member States for the whole range of cooperation, which provide resources for economy and recognition of the authorities. Logically – even or especially for Minsk – wider are the cooperation with the EU, better would be the socio-economic context of Belarus, and therefore, lower would be the risks of popular revolt against the regime. The main condition on the Belarusians side, asks for cooperation free of any democratic prerequisite or pressure. Therefore, Minsk would like to be treated similarly than Russia, China or Tunisia. Unfortunately for it, Belarus is not Russia, neither China, and enjoys even lower support than Tunisia…

The EU assistance for Chernobyl victims appears moreover structurally hampered by the unilateral and nationally-oriented diplomacy of the EU capitals vis-ą-vis Belarus. When some EU Members as Belgium, Italy or Austria give priority to the Chernobyl issues, some of their homologues favour the cultural cooperation, like France, or prefer to assist the NGOs, as Sweden or Denmark. The EU deficits in this Chernobyl assistance are truly blatant, when

compared to the pro-activism demonstrated and maintained by Cuba, which regardless its demographic and economic capacities, has welcomed and treated more than 22,000 children from Belarus, Russia and Ukraine since 1990 in its paediatric hospitals, like the Tarara's one.

The fundamental reasons to explain the EU reluctance to invest significantly the Belarusian chessboard mainly consist in the proximities between Belarus and Russia, where any initiative to "Europeanize" Belarus may exasperate the so strategic Russian partner. The implicit understanding is that more the EU commits itself in Belarus; more the Belarusians would be willing to embark on the EU boat, adding therefore another candidate on the already long list of applicants. While undoubtedly beneficial in the principle, the Belarusian added-value to the EU will raise on the quite long-term, after 20 or 25 years only of membership: this far deadline for getting any benefits of such adhesion subdues the diplomacy of the EU, which comes down to a basic addition of short-terms actions or reactions.

However, the main chance of Belarus – and therefore the first reason to stay optimistic – is its entire location in Europe, on the European continent. *De jure,* according to the EU Roma Treaty, Belarus is legitimate and eligible for a prospect of EU membership, together with the other European Neighbours such as Ukraine or Moldova. An acute expertise on the Belarusian deal convinces that such European perspective officially recognized and activated will be the driving lever to involves the EU at the Belarus' bedside, and at last to assume its duties in favour of its Eastern partner, as much as it deserves, and as much as it needs. From now on, Ukraine is close to the EU doors. Therefore all the efforts from its neighbourhood should support this path, which is the key for the European future of all its post-soviet neighbours, i.e. for their future itself.

On Prospects of Building a NPP in the Republic of Belarus

Dr. ***Yegor Fedyushin,*** *Director of the Institute of Humanitarian and Ecological Technologies of the International Academy of Information Technologies,* BELARUS

Over 22 years have passed since the Chernobyl catastrophe, and for all these years our authorities have been waging a sort of "trench war" against the population of our country. To begin with, in the first days after April 26, 1986, when the radioactive cloud from Chernobyl was already attacking the defenceless population of Belarus in full force, the Republic's authorities were preparing for the May-Day demonstration and reported to Moscow that it was all quiet in their country, and that the Republic was ready to carry out any orders issued by the party and the government. At the same time, this Republic was right in the zone of a man-made disaster on a scale unknown to history. They were waiting for a signal from Moscow!? Our appeals and insistent recommendations by competent nuclear scientists sent to the Central Committee of the Communist Party of Belarus to warn everyone as soon as possible about probable consequences of the nuclear accident in Ukraine and take immediate measures aimed at minimizing the radioactive lesion of our population were met only with a peremptory shout from the Republic's political leaders.

These leaders were the ones who made the political decision to classify all data, and the population was driven out to May-Day demonstrations throughout the country. Political decisions of this kind often lead to tragic consequences for the nation. Now were are not the only ones who know the bitter price of this decision and can fully assess who put the Belarusian people on the brink of extinction because of fear to lose their administrative chairs. In the end, history gives its own evaluation to every political figure. It is also time for us to give our evaluation to criminal negligence of the

government of the Belarusian Soviet Socialist Republic during the first 10 days after April 26, 1986, which lead to huge economic and especially human losses.

Now, the Security Council of Belarus has ignored all lessons learned from Chernobyl and passed a political decision to construct a NPP. This is a vestige of the old thinking from the epoch when the government could do whatever they wanted. They have forgotten that we are living in the 21st century, and the new age requires new political thinking and new policies.

Unfortunately, it is not uncommon for the politicians to disregard the opinion of specialists while solving their own problems – which often are quite different from the true interests of the nation.

The decision to begin the construction of a nuclear power plant in Belarus was passed without wide public discussion, without taking into consideration the opinion of the majority of citizens, and without deep and comprehensive study of the issue by specialists. Therefore, we cannot view this decision as responsible and well-grounded.

Apparently, a serious underestimation of the gravity of this decision and its negative consequences for our country's future exists among the scientists who were consulting our leaders on nuclear power engineering matters. Despite being highly qualified specialists in their particular field, they still, in my opinion, often lack a quality which is so important for any modern scientist – foreseeing the consequences of their recommendations not only on the scale of their own country, but on a planetary scale, including the sense of moral responsibility.

And this is where I believe our scientists have serious problems. The following example is very representative. Back in 1987, at the party meeting of our Institute of Nuclear Power Engineering, I spoke before 246 people present at the meeting and proposed to remit our membership fees to the Children of Chernobyl Fund. It was us, nuclear power engineers, who bore the burden of moral responsibility for what had happened in the first place. Alas, only one person expressed open support for my idea. However, the next day there were already 5 of us, then 10, then 25. We organized a party group and transferred our membership fees to the Chernobyl

Fund through the postal service. But this is a separate topic, and I will not discuss it within the scope of my report.

Today, many of us have been united by the Scientists for Nuclear-Free Belarus movement. We speak in favour of open dialogue with everyone who has an opinion on the problem related to NPP construction. Unfortunately, such people as Aleksandr Voytovich, Stanislav Shushkevich, and Yury Khodyko are among our opponents who support NPP construction. We are also forced to debate with the Security Council that has passed a rash decision, with the management of the National Academy of Sciences that has initiated the development of Belarusian power engineering in this direction, and with representatives of ministries that actively support the idea of "atomization" of Belarus.

On the contrary, the organizing committee of the Scientists for Nuclear-Free Belarus movement consists of scientists who have sufficient experience and knowledge not to be afraid to lose their scientific authority. Thus, we know the true worth of those promises of cheap and safe nuclear power engineering having no alternatives which are brought to us from TV screens and from the pages of many central newspapers.

Calculations are performed using current or even yesterday's prices, giving no mention to constantly rising prices of all energy resources and materials and to actual construction expenses, taking into account that everything, including NPP personnel and experts, will have to be bought. Communicating the truth about the price of the NPP is one of the objectives of the Scientists for Nuclear-Free Belarus movement.

Here are some other areas of our activities:

- popularization of information about true consequences of the Chernobyl catastrophe;
- danger caused by NPP construction to near and far future of Belarus;
- initiating total medical and radiological examination of the country's population.

(I personally consider the last item to be especially important. Let me refer to my own experience: three years ago, having accu-

mulated a considerable dose of radiation, I underwent a number of cleansing procedures and managed to bring the "radiance" level down to 1 Becquerel per kg of body weight. Recently I have had another examination. Living in Minsk and during the summer – in Vitebsk Region, the cleanest part of Belarus, I have once again reached the level of 20 Becquerel per kg of body weight. And what of those residing in polluted territories? But this is another taboo topic for official sources, as if this problem has never existed at all).

On to the next item of our programme:

- initiating public control over the deployment of nuclear campaign;
- scientists' moral responsibility for recommendations related to nuclear technologies;
- moral and criminal responsibility of politicians for consequences of crucial decisions passed by them;
- prospects of development of world-wide and national power engineering;
- coordination of relations with the world anti-nuclear movement etc.

Of course, these problems cannot be solved without understanding and support of the society.

Our knowledge and experience allow us to confidently assert that construction of a NPP in Belarus isn't the best way to ensure energy and economic security of our country. And, despite the fact that the issue of NPP construction has been moved to the political dimension in Belarus, we try to adhere to a different logic – that of reason and scientific truth.

I'd like to point out one more aspect of the problem. The decision to begin NPP construction makes us risk our own future as well as the future of our children and grandchildren. And while we take the risk more or less voluntarily, realizing the extent of danger, our descendants will be forcedly exposed to this risk. It is us who plan on leaving them a legacy in the form of a supposedly "super-reliable" structure, as some experts claim – although they do not deny that some degree of risk still exists. And it is immoral to expose others to risk. Forcing both currently living (though, very few people are enthu-

siastic about NPP construction in Belarus) and future generations to take such a risk is an infringement on their personal freedom.

Of course, we agree that power engineering is the key to a highly developed economy. Current conditions require power supply decentralization which can substantially increase national security. And we support rational use of domestic resources as well as wide implementation of world experience in the field of using ecologically clean energy sources. However, nuclear power engineering cannot be ascribed to this category at all.

Economy is developing in leaps from one significant scientific discovery to another. Science and new knowledge are the only driving forces behind the civilization. In the past century nuclear power engineering played the role of such knowledge. We studied it widely and tried to use it for the national economy's needs. Now we have accumulated knowledge about this type of energy enough to estimate the prospects of its future use. Unfortunately, NPPs turned out to be not as cheap and safe as we wanted them to be.

Today new opportunities allowing moving on to qualitatively different energy technologies are opening before the science. Nothing besides our narrow-mindedness prevents us from using them. It appears, though, that we have no other choice but to do so.

Nobel Prize laureate Zhores Alferov has once said: "If just 15% of funds allocated to the development of nuclear power engineering in the USSR were directed to research in alternative energy sources, we wouldn't have needed NPPs to produce energy at all". Independent foreign experts also claim that if funds expended on NPP construction are directed to the development of other energy sources, in 15 years they will create 15 times more workplaces and will produce twice the energy compared to a VVER-1000 reactor. So, what do we need a NPP for? Isn't it easier just to buy free energy?

Therefore, both from scientific and practical viewpoint, it is much more expedient to invest in more promising areas of power engineering, aiming for the future rather than for the past.

I am certain that in the end everyone will clearly realize the absurdity of the idea of "atomizing" Belarus. We are all working on it. The amount of work is large, but the work itself is noble. I wish success to us all!

Chernobyl – the End of Shagreen Leather

Prof. ***Georgiy Lepin,*** *Belarus*

The accident at the 4th Unit of Chernobyl NPP on April 26, 1986 was not the first one in the history of nuclear power engineering. All in all, there were about one thousand accidents on different levels before it. There isn't a single NPP in the world which did not regularly see accidents and incidents, and neither has there been a single day of the year without an incident occurring at least at one NPP. The two loudest warning bells rang in 1967 at Windscale NPP in Great Britain and in 1979 at Three Mile Island NPP in the USA. The third – and most decisive – warning sounded in Chernobyl in 1986. Besides, there were multiple accidents with military and civilian ship reactors, but they were swept under the rug "for the purposes of secrecy". The unity of stance on this issue adopted by all NPP owners and manufacturers is understandable. They do not want publicity, because sensible people just might realize how dangerous all these nuclear monsters are. The above-mentioned accidents led to thousands of deaths and hundreds of billions dollars in property damage. All this makes any talks about reliability and safety of nuclear power plants pointless.

Alas, especially important is the fact that the danger lies not only with the NPPs themselves, but, to a much higher degree, with the people maintaining them. For instance, the Chernobyl accident was not so much anthropogenic, but rather man-made. No reactor with any "self-respect" would have tolerated the numerous many blatant violations of operating instructions during the hours and minutes preceding the reactor's explosion. Such a situation should urge us to ponder over the very concept of "nuclear power engineering personnel". Those who think they can "procure" the necessary num-

ber of specialists at institutes, colleges and practical trainings are making a glaring mistake, and by doing so are preparing a "sure" ground for future accidents. The people who maintained the ill-fated Chernobyl reactor had all necessary diplomas confirming their qualifications. However, they lacked the most important skill – not just the knowledge, but the feeling of the reactor. This skill cannot be learned, but can only be obtained through many years of experience and at the cost of many trials and errors. When we gather the necessary number of graduates who have just "absorbed" the knowledge accumulated before them but had no time to turn this knowledge into understanding and feeling of the actual reactor, we cannot hope for success of the operation we are undertaking. Those who fail to understand this are ready to make such a mistake today – and thus, to become criminals in respect to their own people.

A huge number of people were sent to Chernobyl after the accident in an attempt to "plug" the numerous "holes" with them. When these people were thrown into the nuclear hell, they were told that "the Homeland will remember them". This was the way it was supposed to be. But the memory turned out to be short-lived. People were written off immediately after they had paid their "debt to the Homeland". Or, to be more precise, Homeland had nothing to do with it. People paid for the faults of those who were responsible for the very existence of nuclear power engineering. In 1990, Chernobyl disaster fighters drew up the draft Law on Social Security for Victims of the Chernobyl Catastrophe. The hardest and longest part was the hearing of this Law in the Supreme Council of Belarus. It was the officials carrying a large portion of blame before the injured who tried to literally tear paragraph after paragraph out of the draft Law. The Law was passed in February 1991 – in the 5th year after the reactor blast. But it was only a temporary retreat of the powers that be. They still hoped to destroy what Chernobyl disaster fighters had achieved.

And, just like in Honore de Balzac's novel, the already limited "shagreen leather" of the Chernobyl Law began to shrink. At first, in contradiction with the Law, the officials started "accidentally" forgetting to index the payments under it. As early as in the 5th year after the Law was passed, such "forgetfulness" resulted in

benefits and compensations for damage payable to disaster fighters and injured citizens decreasing dozens of times. The President said with evident pleasure in one of his numerous interviews on TV that even the people themselves suggested that he should stop the payment of these benefits. No wonder, since it is quite a shame to receive such dribs and drabs – exaggeratingly titled "benefits" – from the state! But our President failed to catch the meaning of the words of these people. The shagreen leather of the Chernobyl Law shrank more and more.

But the rate of this process was not enough for our President: it was way too slow, and the portions were way too small. So, he decided to deal the remains of the shagreen leather a final blow, and issued his Decree No. 349 dated September 1, 1995 "On Regulating Certain Benefits". According to this decree, the majority of the parts of the law which hadn't already been "eaten up" by inflation were "temporarily suspended". This "suspension" has already lasted for 13 years. On December 26, 1995 the Constitutional Court of Belarus ruled this decree unconstitutional and inconsistent with the laws of the Republic. The decree was subject to repeal without the right of appeal or protestation. But what does our "keeper of the Constitution" care about its provisions? He just reminded everyone about his unlimited authority and demanded that his order be carried out. And so, there was almost nothing left of the shagreen leather.

Our "protector of the Constitution" could go on doing his business, but there were problems left that he had to "finish off". One of them was the Chernobyl Ministry. It was created after the accident to coordinate the efforts on overcoming everything what this horrible tragedy had brought to Belarus. This Ministry was doing a few useful things, though not always. Just several steps turned this Ministry in some small and powerless Committee at the Ministry of Emergency Situations. How was it possible to make such short work of the Ministry which may have been the most important one in Belarus, given the fact that almost a quarter of the Republic's territory and population was exposed to radioactive pollution?!

And there was one more such "consequence". Back in 1988, a system of medical protection of the injured citizens of Belarus was

established in the country. This system included the Institute of Radiation Medicine with two comprehensive scientific, treatment and diagnostic units in Gomel, Mogilev, and Vitebsk, the Radiation Medicine Dispensary in Minsk, and the Chernobyl Clinic in Aksakovshchyna. People suffering from the effects of radiation underwent examination and had the opportunity to undergo appropriate treatment. A system of training for scientific and practical personnel in the field of radiation medicine was created. How could all this be tolerated? So, Ms. Postoyalko, who was specially assigned the Minister of Public Health ("Public Unhealth" would be more to the point) was given an order – and the show "got rolling". The Institute was "exiled" to Gomel with only few of its 90 scientific employees remaining. Regional branch offices were closed. This way, the scientific team was "successfully eliminated". The Chernobyl Dispensary was converted into the Centre of Rehabilitation and Balneology, and now it gladly offers treatment for hard cash. At the same time, people who suffered from Chernobyl accident are starting to be forgotten. Aksakovshchyna was turned into a usual medical institution for everyone – but not for the victims of Chernobyl.

Those victims have no one and nothing to count on. It seems that the shagreen leather has shrunk as far as it could – but only to us, while the one "elected by the people" loses his sleep over some remains of this leather, however small they may be. Alexandr Grigorievich told the journalist of one of the German newspapers that the polluted "lands are getting renewed and becoming cleaner". It is unclear, though, how exactly this "renewal" happens. During the years that have passed, natural decay could decrease the radiation intensity by ten percent at the most. "Successful" decontamination measures yielded no results, and radionuclides are in no hurry to be washed out of the soil. Why is our President so convinced of success of an undertaking which was doomed to failure from the very beginning? As it happens, he has an ace up his sleeve capable of resolving the problem in an instant. He found some card players who coined the "Concept of Protective Measures during the Recovery Period". Professor E.P. Petryaev and Doctor of Medicine Ya.E. Kenigsberg turned out to have a very sharp eye, since they

somehow managed to see this "recovery period". They did an excellent job for the "client": many lands were immediately moved to the category of clean ones, meaning that people living of them could be struck off the list of those who suffered from radiation. The number of Chernobyl victims living in polluted regions of Belarus which originally amounted to 2,200 thousand has now dwindled to 1,460 thousand. Where did 740 thousand injured citizens disappear? Alas, some of them have already passed away: this process is happening very quickly in Belarus. The rest were "excluded" from the lists of the injured by petryaevs and kenigsbergs. The "savings" are considerable: 740 thousand citizens struck off the list is no small number. The country disorganized by bad management and drained by construction projects in the field of sports, libraries, and now nuclear power engineering – of course, exceptionally "important" today – cannot take care of its own citizens. The last juices are squeezed out of them with remarkable persistence, all for the purpose of realizing someone's personal plans, which are quite often so absurd and unreasonable that they cannot be understood and accepted from the standpoint of common sense.

Some time ago the Ministry of Nuclear Power Engineering and Industry of the USSR developed the method of evaluating resources, including financial ones, necessary to recover the health of nuclear power station personnel lost as a result of receiving a dose of ionizing radiation. "The price of the accumulated dose" was determined as $4,000 for one man-rem. The collective dose of radiation received by the citizens of Belarus can be estimated only roughly. As of today, this number may amount to about 3.5 million man-rems. Therefore, the total damage caused to the health of the citizens of Belarus is equivalent to $14 billion. This is the approximate sum that will have to be spent if the President's dream about the construction of "our own NPP" is made true. This sum should have been returned to the injured citizens of Belarus and not spent for purposes that are hostile to them by definition. I am sure that this would be doubly as beneficial to our country. We should consider if this opportunity has not already been lost altogether.

There's an interesting point: our President really wants to leave his mark in the history of Belarus. One can say that he has already done that. And how did he manage to achieve such a decisive success! It was Belarus that suffered the most from the Chernobyl tragedy. And it was in this country that the victims of Chernobyl were deprived of any support and left in the lurch by the state. A truly great "achievement" that neither Ukraine nor Russia can ever dream of. Even the residents of Hiroshima and Nagasaki who were exposed to radiation 63 years ago still have a medical monitoring and treatment system. It appears that the one "elected by the people" has not wasted time in the last 14 years and has left a lot of "marks" in the history of Belarus. Should he leave even more of them? I am talking about his wish to present us with a nuclear power plant. We've had enough of the "marks" that our President, whose election was a long time ago and was quite unsuccessful, has left in the history of our country! Enough of stamping his feet in our beloved home of Belarus! This is way too much. And besides, there is almost nothing left of the shagreen leather, and it won't stand any more shrinking.

A Nuclear Power Plant in Belarus – Promises vs. Reality

Prof. ***Georgiy Lepin,*** *Belarus*

The people of Belarus had to withstand some heavy blows in the past century: the Great Patriotic War took a quarter of its population, while the Chernobyl tragedy rendered a quarter of the country's territory unusable and affected the majority of its people. The consequences of these cruel blows continue to test our entire nation for endurance. Every year the population of the country decreases by 50 thousand people: there have been less than 10 millions of us for quite a while already. This is a tragedy of the nation stretched over many decades and centuries – and there's no end to this tragedy to be seen. In fact, even today the people of Belarus are on the brink of survival. However, a new, equally cruel test is being prepared for our country.

Construction of a nuclear power plant on the territory of Belarus is fraught with many disasters and ordeals which are about to be imposed on the nation. Many years of experience in nuclear power plant construction and operation testify to the fact that nuclear power engineering is the most expensive and dangerous of all technologies that allow obtaining electric energy. This danger is related not only to possible accidents: in the process of "normal" operation the nuclear reactor constantly poisons the environment.

We are being told that the construction of nuclear power plants is profitable, and that energy produced by them is the cheapest. Let us start from these issues. The cost of constructing a NPP in Belarus named by the Vice President of Atomstroyeksport is $8–12 billion. The figure of 12 billion is closer to reality, although it is understated, too. A thermal power plant of equal power would cost only $2–3 billion.

According to the data from the USA and Germany, the cost price of energy produced by NPPs is already forecast on the level of 30 cents for new plants, compared to 3 cents for TPPs. Thus, taking into consideration the fact that the cost price of energy produced by NPPs exceeds the total cost price of energy in the country multifold, the very notion of pay-back period becomes pointless. In reality, construction of an NPP cannot pay for itself.

An important characteristic of construction of any nuclear facility is that actual expenses on it are constantly adjusted towards the increase in the process: something was forgotten about, the prices for equipment have changed etc. And then there's the need to replace power grids which will be "recollected" only when construction is already underway. This will result in billions of dollars in additional expenses. The price for reactor fuel constantly and rapidly increases. For instance, since 2000 it has already grown almost 20 times. The budget of NPP construction and operation is like a bottomless barrel: you always need to put something into it, but you can never fill it up.

Let us consider a rather representative example of "disappointed expectations". The Olkiluoto NPP in Finland is being constructed by French company AREVA. The construction is already 2 years behind schedule. The cost of the facility has doubled in the process of construction, reaching €5.2 billion. Over 1,500 remarks on quality have accumulated over that time.

During the past years we have heard many categorical "assertions" and even "oaths". What are they good for? The ones related to costs have already been discussed above. Let us stop and look at some other examples.

"We have made a promise to the people, and we intend to keep it: we'll have the safest nuclear power plant built using cutting-edge technology", – emphasized the head of the state. There's only one question: where will such a power plant come from? In fact, not a single new and "more reliable" reactor has been built, let alone tested, since the Chernobyl catastrophe.

"It is very important for people to know who will assume the responsibility for constructing this plant", – said Aleksandr

Lukashenko. And who assumed the responsibility for the construction of Chernobyl reactor? A single man – Academician Legasov – could not bear the load of this responsibility and took his own life. It will hardly be the case this time, though: oaths are important, but more so is one's life. Moreover, what responsibility can be assumed by a person completely incompetent in this field?

Belorussian authorities often cite support by the IAEA. And this is when the proverb comes to mind: "God save us from such friends, and we'll deal with our enemies ourselves". This organization does everything within its power to resume the construction of most dangerous and hazardous nuclear facilities in as many countries of the world as possible. And it is IAEA that is especially interested in a "breakthrough" in Belarus, since this country suffered the heaviest effects of Chernobyl catastrophe. Thus, it appears that the Belorussian authorities are working not for their nation, but for an organization hostile to this nation.

And what a rush! There's even no time for consulting with the nation and with specialists. The decision is political, as in military or long-gone Soviet times. This is the issue no one – and the people in the first place – should interfere with. Looks like this is how this "trick" was supposed to work. What does politics have to do with this problem? In fact, it belongs only to economic, ecological, and social spheres. And there's one more suspicion: has this whole scheme been put in action to turn Belarus into a nuclear state? Something like Iran. Maybe, the Belorussian authorities are after the same goal?

Now, a couple of words about the logic – or rather lack thereof. Looks like it can also be turned inside out. An example from the "original sources" follows. "Was Chernobyl Power Plant on our territory? No! Who suffered from this catastrophe most? Us, Byelorussians. Where's the guarantee that some plant in Russia, Ukraine, even in Europe is the safest? There are no such guarantees. We cannot guarantee that something, God forbid, doesn't blow up tomorrow, and that we won't be hit by it again. Then why are we refusing to build our own power plant? What endangers our people? Nothing". It would be logical to request that the neighbours (at least, the closest ones) shut down the plants that pose danger

to the Byelorussians. But the inverted logic dictates the opposite: if there's danger around us, we need to add some from the inside. But let us think rationally for a moment. The NPPs around us are situated 20 to 160 km from our borders. In this case, about 80 percent of all emissions from the reactor both during accidents and between them will stay on its own territory, and only 20 percent may reach us. At the same time, a power plant built on our territory will leave 80 percent for us and share the rest with our neighbours. Thus, the construction of "our own NPP" increases the risk for the people of Belarus more than twofold – while the "inverted logic" states that "nothing endangers our people".

A special issue that is persistently avoided is the matter of radioactive waste from our own NPP. In any circumstances, most of this waste will have to be buried on our territory, and this is very expensive and highly dangerous.

We also shouldn't forget that Chernobyl remains a malignant tumour on our country's body which continues to oppress all aspects of its life. To intensify this danger by building a NPP, this time on our own territory, is to commit a sacrilege. Besides, before even starting to construct a new power plant, the country's authorities managed to lose support of their citizens who suffered from the accident at the old – Chernobyl – plant by repealing almost everything granted by the Law on Social Security for Victims of the Chernobyl Catastrophe. All these actions show that the State which is unable to protect its citizens from the disasters of the past has no right to expose them to disasters of the future.

In fact, today Belarus has no prerequisites in energy, personnel, financial, social or moral aspects that could support the very idea of NPP construction. We can only wonder how such ideas, being as unreasonable and harmful to the Byelorussian nation from all standpoints as they are, could cross the minds of our leaders! While the consequences of this obvious delusion have not gone too far, it would be prudent to reconsider the problem and the decisions that have been made. We, representatives of the country's scientific community, are ready to take active part in it.

Belarus has a more economically feasible and safe way of solving its energy problems. Existing power plants in the country do

not operate at their full capacity, and their retrofit will cost much less, will require much less time, will pay for itself in a short time, and will not call for fundamental reconstruction of the power grids. This is corroborated by the results of retrofit of Orsha CHP and project documentation for retrofit of Berezovskaya State District Power Plant.

In conclusion, I would like to say a few words about those "enemies of the nation" who oppose nuclear power engineering: "I will not let them do it using all resources and all authority that are currently in my hands". This is where I wouldn't argue, there are enough resources and authority in the hands of the main administrator to shut up anyone without much effort. But really, is it enough for anyone? Our people are not what they once were. They are starting to understand some things. Peremptory shouts do not have the effect they used to have. And even the "enemies of the nation" are starting to shed their fear and resolutely call a spade a spade.

We urge all those who hold dear not only the future of the Byelorussian people, but the future of our planet, to support us and join the movement "From Nuclear-Free Belarus to the Nuclear-Free World".

Uncompensated Risks of the Byelorussian NPP

Yuri Voronezhtsev, *Physicist, Candidate of Engineering, Executive Secretary of the Commission of the Supreme Council of the USSR for examination of the causes of the accident at Chernobyl NPP and evaluation of actions taken by officials in the post-accident period*

It has been twenty-two years since the largest anthropogenic and humanitarian catastrophe of the 20th century – the accident at Chernobyl Nuclear Power Plant. Its consequences still haven't been overcome and continue to affect the health of the entire population of Belarus. Unfortunately, future generations will suffer from them, too. That is why the hasty decision on commencement of construction of a nuclear power plant in Belarus which was passed recently without wide public discussion gave rise to understandable concern among the citizens of the country whose population has received an unprecedented collective dose of radiation. Indeed, the "peaceful atom" brings us not only a mythical guarantee of "energy independence", but also a number of new risks which, despite the optimistic statements by the authorities and scientists close to them, are not compensated by anyone or anything.

1. NPPs are dangerous even without accidents.

No one has refuted numerous facts testifying that even in the normal mode of operation, without accidents and incidents, any NPP causes considerable harm to the biosphere and the population through emissions of radionuclides formed in the reactor. This results in children's leukemia, increased level of infant mortality, and many other disasters imposed on people living close to NPPs that have been confirmed by research centres of global renown. The table below (which, incidentally, was published on a site promoting nuclear power engineering) clearly illustrates what can pour down

on people's heads in just one year in the area of NPP operation within the "quotas" established by atomic scientists:

Radionuclide	NPP with PWR
IRGs (inert radioactive gases)	$6{,}9\times10^{14}$ Bq
^{131}I (gas and aerosol forms)	$1{,}8\times10^{10}$ Bq
^{60}Co	$7{,}4\times10^{9}$ Bq
^{134}Cs	$9{,}0\times10^{8}$ Bq
^{137}Cs	$2{,}0\times10^{9}$ Bq

In the meantime, the number of registered congenital malformations subject to strict registration in Belarus has already doubled(!) compared to the period before the accident. A huge collective radiation dose received by populations of dozens of countries in consequence of the Chernobyl catastrophe (127 million man/rads according to J. Hoffman and 150 million man/rads (1.5 million man-rems) according to the U.S. Department of Energy) could not but result in serious health damage to hundreds of thousands of people. At least a third of this dose was received by the population of Belarus. In my opinion, deliberate increase of this dose that will be brought about even by a normally operating NPP constitutes a crime.

2. "Cheap energy" is a financial stranglehold on our children and grandchildren.

Proponents of NPP construction claim that the main advantage of nuclear power engineering lies in cheap energy compared to the most common power plants operating on coal and gas. Indeed, the fuel constituent of the cost of energy produced by NPPs is currently lower than at TPPs. However, the capital expenditures are several times higher! For instance, the cost of the new nuclear power unit at Olkiluoto NPP in Finland amounted to almost $4.5 billion at the start of construction. First Vice President of Atomstroyeksport Aleksandr Glukhov has recently announced that his company can build a NPP

with two power units for Belarus for only… $8–12 billion. Ten CCPPs can be built for the same price; moreover, they can be commissioned 3–4 times faster than a nuclear power plant.

The majority of calculation methods used to prove the benefits of nuclear power engineering do not take into account the **real** expenses on dismantlement of power stations past their service life that can stretch out over decades or even centuries. These expenses are comparable to the cost of NPP construction, but they will be borne by our descendants. We can presume that tightened safety measures that will be undoubtedly adopted in the future will increase these expenses considerably.

In Great Britain, decommissioning expenses for a single power unit already amount to £500–600 million (over $1 billion). According to the adopted NPP decommissioning strategy, the reactor core is to be removed 100 (!) years after the power unit is stopped (a new timeframe – 135 years – is currently being considered). The total value of liabilities related to dismantlement of state-owned nuclear power units in Great Britain (UKAEA and BNFL) reaches approximately £48 billion!

The first 600-MW power unit of Barseback NPP in Sweden was stopped in 1999; the second one of equal rated power ceased operating in 2005. Decommissioning of each of these units cost almost $1 billion to the Swedish taxpayers.

Serious scientists and analysts who do not live on nuclear corporations' allowance unanimously agree that energy produced by NPPs is cheap only as long as its cost does not include expenses on waste extraction, transportation, processing, and burial plus the cost of NPP dismantlement, and as long as nuclear projects are subsidized from the state budget.

3. The problem of nuclear waste hasn't been solved anywhere in the world.

The cost of transportation, processing and burial of irradiated fuel (IF) is rapidly increasing around the world. The corresponding "service" offered by Russia already costs around $1,000 per kilo-

gram! Other countries request even higher prices. Besides, many countries have banned "foreign" nuclear waste from being brought into their territory.

Existing IF storages were designed for service life dozens of times shorter than the periods of activity of waste placed in them. These storages are already unreliable; however no one anywhere knows what to do with them. The responsibility is passed on to future generations. It's too expensive to transport the waste abroad, and too dangerous to keep it at home. What do the authors of the nuclear project suggest? Precisely nothing.

4. Dependence on expensive and scarce raw materials.

To all appearances, Russia is going to construct our power plant, supply us with fuel, and store our waste. All this will be done by a country which suffers from serious nuclear fuel problems itself. Annual uranium production in Russia reaches only 3.3 thousand tons, compared to annual demand of 20.5 thousand tons (5.0 thousand tons for Russian nuclear reactors, 4.2 thousand tons for export of fuel assemblies, and 1.3 thousand tons for export of low-enriched uranium). Stock resources are currently being used – however, quite naturally, they are growing short. It was only in February 2006 that Russia managed to solve the import problem, albeit partially, at the summit of the Eurasian Economic Commonwealth in St. Petersburg by signing long-term agreements with Kazakhstan and Uzbekistan.

The rate at which the price of nuclear fuel is growing is second to none. For instance, in June 2007 one pound of uranium cost $136, while back in 2000 the price was just $7 per pound. Specialists forecast that this figure will reach $200/pound in the nearest 5 years.

But even this scarce and expensive fuel will not last long. According to experts, the total energy resource contained in known reserves of natural uranium is 3–4 times less than that of known reserves of oil and gas, and amounts to a meagre few percent of the total energy resources contained in organic fuel, including coal.

5. "Personnel are all-important". But there are no personnel in Belarus.

Even if the nuclear power plant is built, its operation in the country which does not have (and never had) any serious facilities for training appropriate specialists will be not only difficult, but also dangerous. We all know that Chernobyl catastrophe, as well as other "nuclear" accidents, were to a large degree caused by the human factor.

The lack of specialists is even confirmed by "nuclear" officials. Deputy Academician-Secretary of the Department of Physics and Engineering of the National Academy of Sciences of the Republic of Belarus Aleksandr Mikhalevich said that the highest priority should be given to the issue of providing the nuclear power engineering sector with appropriately trained personnel. According to him, "today Belarus lacks human resources for a full-fledged programme", since the operation of two power units of the future Byelorussian NPP will require approximately 1.5 thousand specialists, including 750 with a higher education and 3–5 years of special training.

"Since the first power unit is planned to be commissioned in 2016, we don't have much time. Personnel training is falling behind the schedule and may become the key problem", – says Aleksandr Mikhalevich. Of course, he is absolutely right – but we would also like to hear exactly how these specialists will be procured in such a short time. And the perspectives of their training in Belarus can be easily imagined by taking a look at the deplorable state of affairs in our education system and complete failure of all attempts at reforming it.

6. System risks.

It is my firm belief that such facilities as a nuclear power plant should not be built in a country which lacks public control over the authorities at all levels. Heaven forbid we have a serious accident at the power plant – provided, of course, that it is constructed in

the first place – and the population will once again learn about it from foreign mass media, as it happened in 1986. We cannot eliminate the possibility of another Chernobyl happening in a closed society.

It is unlikely that the citizens of the country will ever know the real cost of constructing the NPP, as well as who and how much has earned in the process and whether there was an alternative to such an expensive project. And I am afraid that the project implementation itself, given our current political and economic model, will be associated with serious leakage of invested money.

It is also unlikely that the population living around the NPP will be paid any compensation, although it is common practice in most countries of the world. After all, Belarus has already revoked all benefits to citizens who have suffered the effects of the "peaceful atom".

In countries where the share of electric energy produced by NPPs is indeed large, their construction and operation is to a large extent financed by private investors. In Belarus, where such investors are inexistent, these expenses may well be imposed on the state budget to the detriment of already scanty social programmes.

We cannot also eliminate the possibility that research related to energy saving will be curtailed as a result of use of large resources for NPP construction.

The list of serious risks associated with the idea of NPP construction in Belarus can go on and on. However, I believe that the above-mentioned factors should be enough for any reasonable individual to arrive at the conclusion that a nuclear power plant in Belarus is a large-scale gamble threatening the safety of both Byelorussians and all our neighbours.