

# ***THE CHERNOBYL CATASTROPHE AND HEALTH***

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## **Introduction**

After the explosion and the fire in the atomic reactor N. 4 in Chernobyl, radioactive fallout were registered in large parts of the Northern Hemisphere of the planet. The northern part of Ukraine, the South-East of Russia and the territory of Belarus have been contaminated to the greatest extent. The level of the radioactive fallout on the territory of Belarus, a non-nuclear state, was two times as high as that of Ukraine and Russia together.

It would have been essential to thoroughly investigate the consequences of the Chernobyl accident. The Belarusian population, which suffers most, should have been extensively studied from the medical and genetic point of view. Unfortunately, the pronuclear lobby, including the International Agency of Atomic Energy (IAEA) made use of all their influence to reduce the significance or to deny the data coming from the most affected countries. Their goal may have been to avoid paying compensations to the states and to the victims: in Belarus two million people, of 500.000 children, still live in heavily contaminated areas. Moreover, the evacuated population and 800,000 workers in charge of the decontamination of the area close to the exploded reactor, the so-called liquidators, are now scattered in different republics of the former USSR.

It is necessary to understand by which methods the pronuclear lobby and the IAEA achieve their goals and to assess the price of this attitude for Belarus: economic, medical, demographic and social problems of the republic appear to be the consequence of this policy. Twenty five per cent of the national budget is spent for the alleviation of the consequences of Chernobyl. In order to ensure a real protection for the victims, it would be necessary to provide much more help to the population, and in a different way, compared to the actual strategy. Rich countries possessing nuclear technology would have been in a position to take over these expenses. Contrary to other industries, the nuclear industry does not need to contract insurance capable to compensate the consequences of a catastrophe such as Chernobyl. This would cost such an amount, that nuclear electricity would become too expensive. Therefore, it would be fair to assign to the states the payment of the debt of civil responsibility.

It is difficult to understand why the Belarusian authorities seem to follow the demands of the pronuclear lobby. It is much easier to explain why the World Health Organization (WHO) became so inefficient in this field: it is still blocked by an "Agreement" signed in 1959 with the International Agency for Atomic Energy (IAEA).

### **The agreement between the WHO and the IAEA and the Chernobyl disaster.**

After the explosion of the reactor, the authorities concealed the information, released it finally much too late and did not consider it necessary to tell the truth [1, 2, 3, 4]. This reaction of the authorities was responsible for "**ignorance and uncertainty**" concerning the radioactive contamination, which followed the explosion of the reactor. Up to the year 2000, the flow of misinformation has not stopped. Thereby it is useful to remember a technical report published by the WHO in 1958 [5]. The report contains a chapter devoted to a <sup>3</sup> policy in case of an accident <sup>2</sup> and ends with a wish: "**Nevertheless, from the point of view of mental health, the most favorable solution for future uses of peaceful atomic energy would be the appearance of a new generation, which would learn to adapt to ignorance and uncertainty**" \_

This apology of ignorance reflects an absence of respect for populations which contradicts the spirit and the letter of the Constitution of the WHO (8). This paragraph was read by Mr. Claude Haegi, representing the government of Geneva at the Conference organized by the WHO on the consequences of the Chernobyl accident, in November 1995 in Geneva. Mr. Haegi also quoted a statement of the Director-General of the IAEA, who, according to the newspaper <sup>3</sup> Le Monde <sup>2</sup> of August 28, 1986, four months after the accident, declared that <sup>3</sup> in view of importance of nuclear energy, the world could bear with one accident of the Chernobyl dimension per year <sup>2</sup>. And Mr. Haegi concluded his speech declaring: "**One Chernobyl is enough. It is necessary to aspire to absolute security**".

This statement of M. Haegi, as well as so many others presented at the WHO Conference, was to be published in the Proceedings by March 1996. However, these texts have still not been published [6]. Apparently, the papers presented in Geneva could have influenced negatively the IAEA Conference, in Vienna, in April 1996. The only explanation for the non publications appears to be the Agreement between the WHO and the IAEA, signed in 1959.

This Agreement states that the research programs of the WHO should previously be agreed, so that their results would not harm the IAEA main objective, which is: "**To accelerate and enlarge the contribution of atomic energy to peace, health and prosperity throughout the world**".

This excerpt from the Statute of the IAEA is printed on the first pages of every publication of this Agency, including the Proceedings of the April 1996 conference of the IAEA already published in September 1996 devoted to the Chernobyl accident [7]. The Agreement guarantees that the research will not negatively affect the development of nuclear energy. Article I, § 3 of the Agreement, specifies in particular that: "**Whenever either organization proposes to initiate a program or activity on a subject in which the other organization has or may have a substantial interest, the first party shall consult the other with a view to adjusting the matter by mutual agreement.**"

According to Article III of the mentioned Agreement:

- 1) ***The International Atomic Energy Agency and the World Health Organization recognize that they may find it necessary to apply certain limitations for the safeguarding of confidential information furnished to them.***
- 2) ***Subject to such arrangements as may be necessary for the safeguarding of confidential material, the Secretariat of the IAEA and the Secretariat of the WHO shall keep each other fully informed concerning all projected activities and all programs of work which may be of interest to both parties.***

The requirement of Article III, demanding confidentiality, which means silence, is contrary to the Constitution of the WHO. In fact, the purpose of the WHO is specified in chapter I of the Constitution of this Organization: "***The attainment by all peoples of the highest possible level of health***"<sup>2</sup>.

Chapter II, Article 2 specifies how the WHO intends to attain its objective, and defines, in particular, the following functions:

- (a) ***To act as the directing and co-ordination authority on international health work;***
- (d) ***To furnish appropriate technical assistance and, in emergencies, necessary aid, upon the request or acceptance of Governments;***
- (q) ***To provide information, counsel and assistance in the field of health;***
- (r) ***To assist in developing an informed public opinion among all peoples on matters of health;***

It is evident, that the provisions of the Agreement prevent open information that is contrary to the Constitution of the WHO. Nevertheless, the Agreement was signed during the 12th World Health Assembly, May 28, 1959. The above quoted clauses can be found in ***Basic Documents of the WHO*** [8].

A very early publication of the WHO warning against the development of the nuclear industry, has been prepared by a group of outstanding experts in the field of genetics, who met in Geneva in 1956. The winner of the Nobel Prize M. J. M. Muller signed this joint statement. [9]:

***"The genome is the most valuable treasure of humankind. It determines the life of our descendants and the harmonious development of the future generations. As experts, we confirm, that the health of future generations is threatened by an increasing development of nuclear industry and the growth of the quantity of radioactive sources. We also consider the fact of appearance of new mutations observed at people to be fatal for them and for their descendants"***.

The publication of the proceedings of this conference was not acceptable to the pronuclear lobby. The IAEA decided soon after its creation to put an end to the freedom of expression in this field by concluding an Agreement with different UN organizations, and especially the WHO. This lasts until the beginning of the 21st century.

### **The attempts of the WHO to disseminate information about Chernobyl in November 1995.**

Dr. Hiroshi Nakajima, Director-general of the WHO, organized an international conference ***<sup>3</sup>Consequences of Chernobyl and other radiation accidents and their influence on human health***<sup>2</sup>, in Geneva, in November 20-23, 1995. Mr. Y. Fujita, governor of the Hiroshima prefecture, was the chairman of the conference. This conference considered the destruction of

Hiroshima and Nagasaki as well as the explosion of the Chernobyl reactor as radioactive accidents, deserving to be compared. Considerable differences were ascertained between these two types of accidents (the above-mentioned three explosions had to be categorized in this context as <sup>3</sup>accidents<sup>2</sup> and not <sup>3</sup> catastrophes <sup>2</sup>). As the Proceedings of this Geneva Conference have not been published, it is impossible to refer to the presentations. It is useful to remind its objectives as stated in the program [10]:

- \* To present the principal results of the first phase of the international program on health effects of Chernobyl accident (IPHECA).***
- \* To compare the obtained results to the results of similar research, related to the health effects of Chernobyl accident.***
- \* To improve (and to update) awareness of the type, the total extent and the harm for health of the Chernobyl accident, as known presently and to be foreseen in the future.***
- \* To make new results of research concerning consequences of other radioactive accidents, available, in order to give more complete information on their health effects.***
- \* To study the effectiveness of the protective measures undertaken in the area of public health during and after the accidents, and to offer recommendations for the future.***
- \* To ensure the development and/or to clarify the state of knowledge concerning the consequences of influence of radiation on human health.***
- \* To provide information on existing or future research within the framework of the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR).***
- \* To earmark the interesting tendencies and changes, which should become an object of steadfast attention of the researchers.***

This program convinced 700 doctors and experts, many from the most contaminated countries to participate in the work of the congress. The IAEA also mobilized the supporters of the atomic industry. Thus, contrary opinions were expressed, which allowed for hot debates. The representatives of the pronuclear lobby tried to prevent the dialogue and Prof. S. Yarmonenko from the Moscow Oncologic Center, demanded that the organizers would remove from the programs of future congresses those speakers, who intended to speak on the effects of low level radiation on living organisms. This apparently became a rule for all the following international conferences, especially in Vienna, 1996.

The reports, debates and presentations of the posters in Geneva were not published. The large document, which presents on 519 pages the statistical data gathered during the first phase of the WHO pilot project IPHECA [11]: <sup>3</sup>Influence of Chernobyl accident on health<sup>2</sup>, confirms the very slow response of the WHO on the Chernobyl accident. Although the majority of people considered Chernobyl as an extreme incident, demanding urgent measures, the IAEA alone supervised the studies and provided the information on this catastrophe. The IAEA coordinated with the national medical authorities the protective measures for the population, considering as its priority to reduce the expenses.

The WHO was never the "co-ordinating authority" as required by its Constitution. At meetings, where the destiny of the victims was discussed, the WHO was even represented by Prof. Pellerin, a promoter of the development of nuclear industry [1]. Five years after the accident, the WHO, finally started studying the problems in the field, selecting 5 priority subjects, among them dental caries, whereas birth defects and hereditary alterations, which the Committee of experts gathered by the WHO [9], considered as a priority, were carefully overlooked.

As the Proceedings of the WHO-Geneva Conference remain unpublished, it seems to be useful to recall some presentations. M. Martin Griffiths from the UN Humanitarian Department in Geneva, stated that people still do not know the truth, and that many are still living in contaminated zones. He requested the WHO to continue its research work and to provide assistance, as he feared that everything would be stopped without adequate financial support. According to M. Martin Griffiths 9 million people are sufferers from Chernobyl, and the victims of the accident are constantly growing in number.

Dr. Y. Korolenko, Minister of Health of the Ukraine, noted that the nuclear fallout contaminated the largest part of his country. Thirty million people drink contaminated water from the Dniepr. Everyone was affected by I-131 and the specialists now perform measures to reconstruct the radiation dose of Cs-137, received by the population. The minister mentioned lesion of the endocrine system and declared that diabetes mellitus had increased by 25 percent (This was not related to diet). Knowing about the social consequences of the insulin-dependent form of diabetes, it is easy to understand the deep concern of the Minister, who recalled the financial situation of his country in that situation, and asked all the states for help.

Prof. E.A. Nechaev from the Ministry of Health and Medical Industry (Moscow) indicated that 2,5 million people were irradiated in the Russian Federation following Chernobyl, and that 175.000 people continue to live in contaminated regions. He showed the increased incidence of a very aggressive form of cancer of the thyroid gland in small children, and the increase of birth defects from 220 up to 400 in 100,000 newborns in the contaminated regions. The frequency of similar diseases ranges within 200/100,000 in clean regions of Russia.

Prof. Okeanov from Belarus presented the results of his epidemiological research, in particular, data based on the national register of cancer, recognized by the WHO, which has been established in Belarus in 1972. Whereas leukemia increased in Hiroshima within the first years after the bombing with a peak between the sixth and the eighth years in Chelyabinsk the maximum occurred after 15-19 years. Okeanov noticed an increase of leukemia among liquidators only after 9 years, but the peak has not yet been reached. He stated that those liquidators, who worked more than 30 days in contaminated areas, have three times as many leukemia as their colleagues who worked there less than 30 days. The period of exposure to radiation seems thus to play an important role. Other forms of cancers are also increasing: cancers of the bladder doubled among the liquidators. The number of cancers of the kidneys, the lungs, and other organs also increased in the Gomel region, an area heavily contaminated by the nuclear fallout with.

The report of this group of Belarusian scientists showed also an increase of cardiovascular diseases among the liquidators, from 1,600 up to 4,000 per 100,000, and up to 3,000 per 100,000 persons living in zones of heavy radioactive contamination. They noticed marked alterations of the immune system, increase of chromosomal aberrations, loss of sight, in particular due to cataract among young subjects. The speakers showed a doubling of mental retardation observed in children as well as mental changes in adults. He insisted on the necessity to study the increase of gastro-intestinal disorders, which he also observed. Among documents received by the WHO, there were unpublished presentations, e.g.: a document of professor Okeanov in Russian of 1994 [12].

All the data submitted in Geneva in November 1995, were not available in March 1996 as officially promised [6]. This delay may well be in relation with the decision of the IAEA, to definitely close the debate about Chernobyl at its own Conference, in Vienna, April 1996 [7].

The publication by the WHO of the Proceedings of its 1995 Conference could have prevented the IAEA from achieving its objective: to put an end to discussions about the health effects of the Chernobyl accident.

### **The IAEA Conference, April 8-13 1996, in Vienna**

The title of this Conference was "*Ten Years after Chernobyl*". The participants had been selected according to the approval by the ministry of industry and the ministry of international affairs; the ministry of health was not consulted. During the plenary sessions, the speakers expressed contempt and haughtiness towards victims of the disaster. Actions to be taken after the future major accidents, which were considered as unavoidable, were also discussed at the congress. The aim of the discussion on this topic was very clearly formulated: to reduce expenses for the relevant industries, to limit or even avoid evacuation of people from highly contaminated zones, to keep the media under severe control. They believed that "alarmist", "stressful" reports were basically causing practically all the Chernobyl connected health problems.

The speakers for the main reports and especially the chairpersons of the sessions had been instructed to avoid discussions on "difficult" problems related to health, particularly those deriving from the chronic incorporation of Chernobyl radionuclides from the environment in the organism. Those speakers also called for the silence of mass media in case of a catastrophe, since, they believed that "alarmist" reports were basically causing practically all the Chernobyl-connected health problems.

The authors of the main presentations confined themselves to the three types of illnesses (acute irradiation syndrome, mental deficiency in children irradiated in utero, and thyroid cancer, in children exclusively), which had been admitted to be the essential pathological findings due to the increased ionizing radiation caused by Chernobyl. All the other illnesses put into the large catalogue of psychosomatic diseases associated with unjustified fears, or to some kind of social protest, having nothing to do with radioactivity.

The acute radiation syndrome was one of the rare real "accident's outcome". This syndrome led to discussions to determine if the number of deaths was 31 or 32. These deaths were practically the only ones taken into consideration by the IAEA, as a consequence of the Chernobyl catastrophe.

However, when IPPNW members had rallied in Kazakhstan in order to help the population to stop the Soviet atomic tests, General-in-Chief Iliencko showed memorial shields on the walls of the Officers<sup>1</sup> House in Semipalatinsk. The featured the names of local residents killed during the two world wars and the Afghanistan War. There was a further list of people who died for the nation. The General asked us: "Do you know who are on this list? They are our Chernobyl liquidators !"

The Soviet Union sent 800,000 soldiers, civil experts and foremen, their average age being 33 years, to the site of the disaster to try to decontaminate it, isolate and stabilize the reactor's ruins. We met the widows of liquidators in Moscow. Several years ago, there were already more than a thousand of them, and they kept gathering new files and photos of other deceased liquidators "Moscovites husbands", who died from new diseases, which they heroically acquired during their service, neither generally acknowledged posthumously nor always glorified by the nation.

As for the liquidators, E. Marchuk, the Ukrainian Prime Minister pointed out at the IAEA Conference [7], that in his country, 3.1 million people were exposed to radiation at the time of the explosion. Many remain in the contaminated area. Among the 360,000 Ukrainian liquidators, 35,000 were already invalid.

Although at the conference IAEA conceded the existence of neuropsychic diseases in children whose mothers had been exposed to radiation during their pregnancy. The speakers denied the existence of similar diseases in adults due to the radiation around Chernobyl, although this is a well-known phenomenon. The organizers tried to present victims suffering from neuropsychic diseases (in particular, among the 800,000 liquidators) as malingerers, raising claims for more financial support, or possessed by unjustified fear of radioactivity. IAEA experts first invented the new terminology of "radiophobia". Later, when negative reaction to this concept arose, the term of "environmental stress" was created to qualify neurovegetative and subjective disturbances as well as a complex of other illnesses, caused by Chernobyl.

The Permanent People's Tribunal (3) judged the behavior of international organizations, especially the IAEA, national commissions for atomic energy as well as governments, which finance them on behalf of the interest of the nuclear industry as follows: **"The absence of concern for these real outcomes of radiation exposure, was in itself one of the ways in which the victims were revictimized after the disaster"**.

The IAEA has done its best to allow those responsible for what had happened, as well as the countries possessing nuclear know-how and the Western atomic lobby, to save as much as possible on the expense of the victims of the Chernobyl catastrophe.

### **Cancer diseases caused by Chernobyl.**

After many years of obstruction, in particular during the IAEA conference in 1991, the experts of the IAEA had to admit the existence of thyroid pathologies, partially brought about by Iodine 131, discharged into the atmosphere by the blow-up in Chernobyl. According to Bandazhevsky that illness are caused by several radionuclides (e.g. Cs-137, Sr-90 in tissues of different organs. Their toxicity may be synergistic [13]. During discussions on the thyroid cancers, the official speaker of IAEA mentioned that this was "a good cancer". We do not think, that mothers of children, ill with cancer and often having metastases in their lymph nodes and even in their lungs, or that the surgeons who operate those children share this view.

The IAEA tried to show that it would be easy to distribute tablets of stable, non-radioactive iodine among the population in order to prevent thyroid cancer. Doctors were aware of such preventive measures before the catastrophe. However, with the exception of Poland, neither the politicians nor the technical equipment allowed to undertake in time such preventive actions.

During this debate, one of the speakers specified that iodine tablets have to be ingested before the radioactive cloud appears, thus ensuring their maximal efficiency. This seems to be quite problematic, as they call at the same time on the mass media to remain silent in case of a future accident "as to avoid fears". The immediate distribution of iodine pills should be envisaged not only in the radius of 5-30 km, but of 500 km and over.

The IAEA officials considered also long-term effects [7] and made the following conclusion: **"Ten years after the Chernobyl accident, in the three affected countries, there are no serious after-effects caused by the radioactivity as a consequence of this accident, except the dramatic**

**increase in numbers of thyroid cancer diseases in children, exposed to the radioactivity in the most contaminated regions. The death rates do not show any substantial raise due to cancers, which could be related to the accident at the Chernobyl nuclear power plant. In particular, there is no serious increase in the number of blood diseases even among liquidators, i.e. the diseases which were of greatest concern after a radioactivity contamination."**

The wording of this conclusion will be discussed later. However it was contradicted by the co-chair person, Prof. Okeanov, who elaborated on the cancer diseases. His task may well have been on the contrary to remain silent.

The discussion following the <sup>3</sup>official<sup>2</sup> report on cancer diseases and the conclusions set up, was strictly restricted to radiometry. The first speaker tried to discuss the problems of cancers, but was forced to leave the floor. When I answered the question as to the topic of my report, I claimed my great interest in radiometry, thus gaining a chance to ask a question to Prof. Okeanov: "At the WHO Conference [6] in Geneva in 1995 and later at the congress run by an NGO in Minsk in March 1996, you have shown data of significant increase of cancer? Would you care to comment?". Okeanov had showed that the global tendency of number of cases of cancers was increasing, liquidators being at the peak of the curve. The incidence of cancers and leukemia was depending on the duration of their exposure to radioactivity.

The increase in numbers of thyroid cancers has been registered in Minsk since 1989. Leukemia in small children, whose mothers had been exposed to radioactivity during their pregnancy, was observed that early, too [15], and followed the mechanism described in the late fifties by Alice Stewart & al (16).

Since 1993-1995, epidemiologists have been observing an increase in the numbers of cancers, mainly among young people, connected with a strong dose of radioactivity after Chernobyl. The liquidators were on the average 33 years old.

The chart of AE Okeanov, which I presented at the IAEA conference, was published in the Proceedings [7].

The number of cases of cancers per 100,000 inhabitants who have been irradiated to some extent compared to 30,000 liquidators exposed more and less than thirty days.

Cancer	Belarus population	Belarusian liquidators (More than 30,000 cases)		
		total	irradiated > of 30 days	irradiated < of 30 days
Colon	12	18,5	20,1	13,4
Urinary bladder	13	31,1	32,1	27,1
Leukemia	10,4	23,3	25,8	16,4
Total	35,4	72,9	77,0	56,9

During the discussion in Vienna Prof. Okeanov confirmed his data and added that the cancer of the thyroid gland in liquidators also increases. He stated that in Gomel, 180 km from Chernobyl, "**an apparent increase in the number of cancer of the colon, the rectum, the lungs, the breast and the urinary system is observed**".



Okeanov underlined the importance of continuing the epidemiological research. Alas, his Institute, whose quality was recognized by the WHO (France, Germany, Switzerland do not have similar national cancer registers), has been dismembered some time later. This appears to be a deliberate step aimed at the suppression of epidemiological data in connection with Chernobyl.

In Hiroshima, the latency period for cancers of the thyroid gland and leukemia in small children was 4 to 5 years. Petridou & al [15] observed an epidemic of leukemia in small children after the passage of the radioactive cloud in Greece, 1,000 km from Chernobyl. It is therefore very disappointing that the WHO involvement started its studies too late to assess leukemia in infants irradiated in utero.

For the majority of other cancers however, the latency period lasts about 9-30 years and more. This explains the haste with which the pronuclear lobby wanted to stop research in this field. The dismantling of the cancer register, an institution that could demonstrate with accuracy to the world how many tens of thousands of cancers would be caused by Chernobyl serves well the IAEA and the pronuclear lobby.

Let's return to the conclusion of the Proceedings of the IAEA Conference, which contains the following statement: "***No major increase in the incidence or mortality for all cancers has been observed that could be attributed to the accident***". Not knowing the context, it is possible to assume that the phrase is not a barefaced lie. However, it is preceded by the statement, which clarifies the essence: "***..Apart from thyroid cancers, there are no evidence of a major public health impact to date of radiation exposure as a result of the Chernobyl accident in the three most affected countries***".

Utilizing a misleading technique, the IAEA selects the false parameter: the mortality rate caused by cancers just 10 years after the catastrophe. At this stage only the morbidity rate would be a permissible parameter in this context [17]. Cancer in younger persons is a dramatic event for families, friends and of course for the patient himself. The treatment of such cancers requires long-term hospitalizations, surgical interventions, chemotherapy, and absence from professional activity, which are extremely expensive both for the society and for the families. Meanwhile, the modern methods of treatment allow to cure some forms of cancer and, in many cases, to put off the lethal outcome. Therefore in 1996, the selected parameter should have been the morbidity and not the mortality

Will the parents, whose children undergo medical treatment for leukemia, even when the child has completely recovered, consider that there were "***no serious health effects***"?

Such outright lies, contained in this conclusion were designed to permit the nuclear lobby to keep on building "reliable" nuclear power plants. Did not the promoters of nuclear reactors tell us over and over again that this industry is completely reliable? Today the nuclear lobby intends to sell nuclear power plants with a new advertising slogan: <sup>3</sup>they are even more reliable than before<sup>2</sup>. This commercial argument is not related to any scientific reality. We do not want to prove this hypothesis after all those lies we heard so far.

### **Diseases caused by radionuclides incorporated in the organisms**

Chernobyl diseases affect up to 90 % of children in the contaminated zones. These diseases must be categorized, according to the opinion of the IAEA, as not related to radioactive

contamination. **"If real, these increases (in the frequency of a number of non-specific detrimental health effects) may be attributable to stress and to anxiety resulting from the accident."** The stress contributes to symptoms in 80 % of adult population, consulting with practitioners in Western Europe. The IAEA may have hoped to find at least a similar percentage of stress in the inhabitants of the contaminated regions, as well as among the liquidators and the settled out population.

Nevertheless, despite a severe selection of the speakers, and a strict control on the discussions at the Vienna conference in 1996, the chairmen of sessions and experts invited by IAEA could not achieve unanimity in this area.

During the first weeks after the accident, the territories of Europe, Scandinavia, the Alps, the Jura, the Balkans and Turkey were contaminated by enormous amounts of iodine 131. Byelorussian doctors revealed quite early the health effects of this contamination. After 1986 other radionuclides with relatively long-lived half-lives (approximately 30 years for Cs-137 and Sr90; 240 centuries for plutonium), had already begun to alter the functions of organs (heart, kidneys), nervous and immune systems, and the totality of the genes in cells, especially of those that were closer to incorporated radiation. The map of the nuclear fallout (I-131 and Cs- 137), appeared soon after the explosion of the nuclear reactor due to the outstanding work performed by the team of Vasily Nesterenko [18], whose scientifically proved, but alarming reports were the cause of his dismissal.

Facing the dramatic problems of his country, this physicist could fortunately continue his research due to support provided by western charitable funds, and his work to protect the population forced to live in contaminated regions [19]. His information on the contamination was not made public by the authorities. The world was late to find out about it, too late [20].

In the Gomel State Medical Institute under the leadership of its outstanding young rector, Professor Youry Bandazhevsky, the researchers studied the influence of radionuclides incorporated by the human organism, and the pathological changes leading to serious diseases of various organs [21]. Those are the diseases of the majority of the adults and 90 % of children forced to live in zones with a heavy radio-contamination.

Professor Bandazhevsky, a pathologist, showed in experimental models, that the laboratory animals, feeding on contaminated food similar to the one that the inhabitants of the contaminated regions are obliged to eat, present morphological and functional changes similar to the processes observed in the people. His experiments show, in particular, the damage caused by Cs 137, and prove, that for this isotope, whose period of biological half-decay (i.e. the time necessary for a human being to halve concentration of a mentioned radionuclide in organism) is shorter than a year, it is possible to use medical drugs to reduce its toxic and radioactive burden for the organism.

The studies of the Department of Pathology of the Gomel Medical Institute offer also to the researchers a better understanding of the diseases provoked by a chronic intoxication of organs or systems after incorporation of Cs 137. In addition to the whole program of research at his Institute Bandazhevsky supervised 30 candidate dissertations and has published 200 articles and reports, some of them already translated into English [13, 21, 22].

The damage caused by Cs-137 starts already in the prenatal phase. The placenta serves as a filter between maternal blood and the blood of the foetus, and protects against foreign molecules

such as drugs, but also against this radionuclide during the whole period of pregnancy. Placenta therefore accumulates considerable quantities of Cs 137, more than tissues of the maternal organism [21]. This accumulation of toxic molecules and radioactivity in the placenta, close to the cells responsible for the secretion of hormones necessary for the normal evolution of the pregnancy, appears to be responsible for the abnormal levels of several hormones. Morphological anomalies are more common when high Cs 137 concentrations are found in the placenta. The fetus suffers from anoxia, the risk of abortion increases. Furthermore, incidence of birth defects in children whose mothers live in contaminated zones is twice as high as compared to those, whose mothers live in clean regions.

If the mother lives in zones of radio-contaminated zones, breast-feeding will lead to rapid accumulation of radionuclides in the organism of the child. During childhood, children will continuously incorporate radionuclides, in particular Cs - 137 contained in milk, vegetables, fruit etc. This chronic intoxication of different organs leads to frequent diseases, such as abnormal blood pressure, cardiac arrhythmia, but also to allergic diseases, chronic infections, due to immune deficiency.

Bandazhevsky has developed methods to protect those children. This would require from the authorities, on the one hand, to recognize the problem and, on the other, the willingness to help these populations by educational measures, adequate food intake and intermittent treatments. There exist possibilities to remove partially the Cs 137. Professor Bandazhevsky tested several substances: pigments, adsorbents, algae, among others. The best results were achieved with an extract of apple pectin, able to fix Cs 137 and to prevent its absorption. It may also remove it partially from the organism, the mobilization and elimination being mainly with feces.

All these measures reduce the load of toxic radionuclides in the organism; this approach is essential from the medical point of view. The high concentration of Cs 137 in certain organs or tissues lead to irreversible damages, when this radioactive load lasts for years or exceeds certain limits.

From 1996 to 2000, Professor Vasily Nesterenko and his Belarusian Institute of Radiation Safety "Belrad" carried out measures on the internal contamination using spectrometers. More than 50.000 children at schools and kindergarten of contaminated regions of Belarus took part in this project. The Institute of radiation safety found excessive levels of Cs - 137 in the organisms of children in contaminated areas. Many accumulated 200-400 Bq/kg Cs - 137 in their organism. Children living in Narovlia, Yelsk, Tchettersk, Vetka, Korma, and Stolin regions had up to 1500-2000 Bq/kg, some children have reached contamination doses of 4000-7000 Bq/kg.

The correlation made by Professor Y. Bandazhevsky, show that if a child's organism has a content of Cs - 137 of more than 50 Bq/kg, pathological disorders of the vital organs or systems will occur. That is why the Institute "Belrad" has carried out since 1995 the protection of such children, using a preparation with pectin, vitamins and essential elements, "Yablopect".

The intermittent use of pectin is recommended for children with an internal Cs 137 contamination of more than 20 Bq/kg in their organism. The reduction of radionuclides in a child's organism is 30-40 % after taking 2-3 tablets per day of this preparation for one month, 3 to 4 times in a year with at least 2 months intervals between treatments. The reduction of the internal dose of Cs - 137 in children's organisms, reduces 2-3 times the annual contamination dose.

These tablets diluted in water are well accepted by children (the drink tastes like an apple) and are well tolerated. If this treatment is initiated early enough, the symptoms may be attenuated. The goal would be to prevent the diseases or in advanced cases, to stop their malignant evolution such as cardiac failure, hypertension etc.

This research should raise interest among physician, concerned by the health care of the victims of the Chernobyl accident. Non-governmental organizations (NGOs) of Ireland, Sweden, Belgium have generously contributed to these programs. It is surprising, that this assistance to the victims became an object of spiteful pamphlets and inappropriate irony in some places. When Professor Nesterenko had the possibility to present the results of his research in Western Europe, in order to find new ideas and support, some participants made rather aggressive remarks. There may be a competition between people working the whole year to help local population and scientific tourists from different western countries who collect data during their visits in the contaminated regions.

Electrocardiographic changes were noticed in a large number of first year students of the Gomel Medical Institute, coming from contaminated regions. Unfortunately, those changes tended to worsen during the following 4 years of their studies. The heart muscles (myocardium) concentrate more Cs-137 than other tissues. The circulatory system is affected by the "Cesium cardiomyopathy", described by Bandazhevsky. The preventing of this disease in people living in contaminated areas would be their relocation, or a correct diet, which as a rule is too expensive for the population, and intermittent pectin cures.

The endocrine system is also very sensitive to Cs-137. The thyroid and the placenta have already been mentioned; there are several diseases of the thyroid many are associated with the increase of the antibody titers against the thyroid cells, which leads to hypothyroid function. Such functional disturbances are 100 times more frequent than cancers. They may have a very negative impact on mental and physical development of children.

The immune system is highly sensitive both to internal and external radiation. This protective system relies on the white blood cells, e.g. lymphocytes. Alterations of this cell system may lead to immune deficiencies as in AIDS. Titov et al. have shown, that the production of antibodies is abnormal in contaminated children [23]. The health disturbances of this complex system include allergic diseases, like asthma. Allergy for cow milk and fruits is observed in 50% of the school children and students in Gomel.

Autoimmune diseases occur when the cells, designed to fight intruding organisms such as bacteria, viruses or cancer cells, attack the normal cells of an organ. When Beta cells of the pancreas face a self-attack by lymphocytes, this may cause severe diabetes mellitus.

Many aspects of this pathology were presented during the NGO congress in Minsk (24). As a consequence of Chernobyl the incidence of diabetes mellitus had increased by 28%, more or less the same as in the Ukraine; Research conducted by Tatiana Voitovich, endocrinologist in Minsk, shows that after Chernobyl, a new form of diabetes has appeared: an insulin-dependent, unstable form of diabetes in very young children. The child is unconscious when he enters into the hospitals. His blood sugar is very difficult to stabilize with insulin injections. This form of diabetes affects the patient's condition during all his life. It was very rare before Chernobyl. The number of cases of insulin-dependent diabetes has doubled in the Gomel region.

## **Ignoring the Problems**

At the IAEA conference, the problem of insulin-dependant diabetes has not been quoted among the diseases caused by Chernobyl, although it was described after the bombing in Hiroshima. The technique for evading this issue during this pronuclear conference is worth telling. During the discussion, I asked whether there existed any link between diabetes and ionizing radiation. The chairman of the session spoke before the speaker could answer, and said: "You have here experts from all over the world, the best specialists in this field. The fact that none of them has raised his hand to answer your question proves that the ionizing radiation cannot cause this type of disease".

In connection with this answer of the chairperson, Prof. Viel (17) exposed methods, used by those who do not want to show a link between ionizing radiation and pathological findings. He quoted similar answers or statements to the one I heard: <sup>3</sup>The experts were unanimous in the view that... there is no association between radiation and any health <sup>2</sup>. Prof. Viel added that such experts may <sup>3</sup>conduct inadequate epidemiological researches by integrating epistemological errors. A classical method was to select mortality instead of morbidity, e.g.: to stop the investigations too early when studying cancers, as it was the case after Chernobyl.

The results of such studies show no statistically significant differences. The hypothesis has therefore not been proved. Promoters conclude that it is false, which allows them to pretend that everything is in order and the atomic industry safe.

## **The dismantlement Gomel Institute**

Lesions of the immune system in organisms contribute to the development of cancers in younger subjects. We must keep in mind that cancers are only the visible part of the iceberg, represented by the totality of the diseases caused by Chernobyl. That is why the scientific world was extremely interested by the research of Professor Bandazhevsky [22], which allow to discover or imagine the true dimension of the iceberg. The systematic studies of this research group allowed characterizing new diseases due to cellular damages caused by the accumulation of radionuclides.

Bandazhevsky studied also other radionuclides, e.g. Sr-90, which accumulates in the bones, close to the blood-producing cells, erythrocytes, including mother cells of the immune system. Sr-90 is much more stable in the human organism than Cs 137. Internal contamination of the organism may also be due to particles of plutonium fixed in the lungs, lymphatic or other tissues. Bandazhevsky considers the synergy between the toxicity of the different radionuclides as a complementary problem.

The arrest of Yuri Bandazhevsky, Rector of the Gomel Medical on July 13, 1999, shocked those who knew him and his publications. This dynamic teacher and highly motivated researcher devoted himself totally to his work, which he considered to be his debt to his country, and in particular, to the victims of Chernobyl. Bandazhevsky created the Gomel Medical Institute and designed its scientific and research work on the causes of the diseases of the population living in the contaminated areas. Amnesty International reacted at once, considering Bandazhevsky as a potential prisoner of conscience [26]. This opinion was reinforced when the Prosecutor, Oleg Bozhelko, said 9 months after his arrest that he held no proof for his accusation.

Now the Institute has been placed under the direction of a rector "of a follower", who rejected the previous direction of research. This is one of the most brilliant victories of the pronuclear lobby over.

The international solidarity was able to release the prisoner. However Professor Bandazhevsky lost his job, his research instrument, his data, the teaching activity and his income. He is in need of help. His health has been seriously undermined; he has lost 20 kg due to extremely severe conditions in jail. Our solidarity should now allow him to find the way and means to continue his research and to publish his findings. It is also necessary to find money to pay the services of a lawyer

### **Mutagenic and teratogenic effects**

From the ethical point of view, the genetic and hereditary damages are the most disturbing consequence of the radioactive pollution. The impact on the genome, i.e. the change in chromosomes or genes, which cause an increase of genetic diseases and birth defects in the coming generations is threatening the workers of the nuclear industry. At all stages of the uranium cycle, from the uranium mining to the management of wastes, including the maintenance of "normally functioning" nuclear facilities, radionuclides are released, in the form of gases or particles, liquids or solids. Radiation leads to an increase of a number of genetic. These were the warnings expressed by the experts invited by the WHO in 1956, when the nuclear industry began to develop [9].

After Chernobyl, changes of the genome were found not only in rodents close to Chernobyl or in Sweden. Children living in contaminated regions, in a radius of 250 - 300 km from Chernobyl show an increase in mutations; [27]. Dominant mutations may be apparent at birth, or become manifest during life. However most of them are not compatible with survival and can cause abortions. Recessive mutations induce genetic diseases and congenital deformities in the next generations. Thus, it will be necessary to wait up to the third to fifth generations of affected by the Chernobyl fallout to observe the full extent of the damage caused by the Chernobyl catastrophe in the families.

### **Genetic anomalies in fishes, swallows and rodents**

A. Slukvin, a former USSR fishing expert, compared two industrial fish farms for carps. The first was situated 200 km from Chernobyl in a zone with a relatively low level of contamination (about 1 Curie per square km), the second, 400 km away from Chernobyl, in a zone of very low contamination. Since 1988 up to 70% of the fertilized eggs did not produce larvae, and after 6 months, the young fishes in the area where the muddy bottom was contaminated with Cs 137 major deformities were observed in 10 to 20% of the carps, depending on the radio-contamination of the pond [28]. The normal development of carps was still possible 400 km from the exploded nuclear power plant. Prof. Rose Goncharova directed Dr. Slukvin's thesis.

The generations of rodents and birds around Chernobyl follow much quicker than in man. This allows already studying the increase in deformities, caused by recessive genes in animals living in contaminated areas.

A group of Swedish researchers compared a population of swallows, nesting in Chernobyl, with swallows from uncontaminated regions in the Southern Ukraine and a region of Italy. They studied the DNA structure of the minisatellites of adult and young swallows, as did Dubrova in

human [27], in chromosomes in the adult swallows and their offspring. The Swedish researchers discovered a statistically significantly higher mutation rate in Chernobyl swallows compared to those living in clean area [29]. Furthermore, they observed an increase of recessive genetic abnormalities in the Chernobyl swallows. Mutants had white spots on their feathers; they had also a much lower chance to survive. Year after year, observations showed a progressive increase in those disorders in the contaminated areas compared to the Southern Ukraine or to the control zone in Italy. The differences were statistically significant.

A number of studies were devoted to rodents living in more or less contaminated areas [30, 31, 32]. The habitat, where these wild rodents (bank voles) live, has a decreasing radioactivity rate, since Caesium-137 is seeping in the soil with rainwater. One could have expected a positive reaction of these animals to these improving radiological conditions. Yet, genetic abnormalities increased from one generation to another [30, 31]. Goncharova and Ryabokon consider this as a kind of reverse adaptation to radioactivity, an increased fragility of the genome.

Baker and his colleagues [32] studied the DNA in one of the genes, transferred to baby bank voles exclusively from their mothers. They observe various mutations from generation to generation, i.e. an alteration of the base of the studied chromosomes, which overpasses 100 times the mutation rate observed until today in any animal species.

For geneticists point of view, human beings and rodents may well be compared. Commenting the publication of Dubrova & al. and that of Baxter & al, Prof. Hillis, from the Texas University, concluded his editorial in *Nature* (April 25, 1996) as follows: "***We know now know that the mutational effects of nuclear accidents can be much greater than suspected and that evolutionary rates in at least parts of a eucariotic genome can be raised well beyond levels previously considered possible***" (33).

The article by Y. Dubrova & al. was published in the same issue *Nature* [27]. This team working with Prof. A. Jeffreys, Nobel laureate examined children and their parents, living in the contaminated areas 250 -300 km north from Chernobyl. Compared with children in uncontaminated regions. These children of Belarus showed suffered a doubling of mutations in minisatellite loci. The mutation rate decreased with the degree of radioactivity in their parents<sup>1</sup> residence place. A control group was selected in the United Kingdom due to the overall contamination of the Belarusian territory.

Experts think that a low, but chronic dose of radioactivity, is very dangerous thing for the human genome

In May 1997, the WHO annual report, published on the occasion of the World Health Assembly (WHA) attested that the number of cases of cancers will double within the next ten years. However, this report says that this is due to the growing life expectancy [34]. Such an analysis does not distinguish between the cancers in very old people and those in children and in young adults, which increases most in the Chernobyl regions.

The same publication of the WHO (34) shows an important increase in the number of cases of diabetes. In rich countries, Type II concern people with excessive food intake. Without further explanation, this report indicates that the number of insulin-dependent type I diabetes will also increase in young people. Here we should recall the report of Mr. Korolenko, Ukrainian Minister of Health at the WHO conference in 1995, which was not published [6]. He underlined the 25%

increase in the number of cases of diabetes after the accident at the Chernobyl nuclear power plant in a population where excessive food intake is rare.

### Birth defects in children

At the IAEA conference in Vienna, 1996 [7], the speaker reporting on teratology as a consequence of the Chernobyl accident, made use of the same argument as the lawyers of the chemical industry that produced in the sixties a tranquilizer, Thalidomide, which appeared to be extremely teratogenic, i.e. provoking a number of birth defects in children whose mothers had absorbed it; This drug caused also birth defects in monkeys, birds and insects [35]. The speaker asserted: *"The absence of any register proves that the development of birth defects is not caused by the Chernobyl accident"*.

Of course, the absence of a register is not a proof of the absence of a causal relationship between the increase of birth defects and Chernobyl. But the falsity of this statement is more shocking when Belarus is concerned. Since 1982, i.e. 4 years before Chernobyl, Belarus had a national register of birth defects, developed by the Belarusian Institute of Birth Defects and Inherited Diseases, under the leadership of Professor Gennady Laziuk [36]. This Institute records and checks the cases of birth defects, observed in the country. It is compulsory to report ten birth defects, to be detected in children up to 7 days after birth, or in fetuses in case of spontaneous or therapeutic abortions. Following anomalies must reported in any case: anomalies of the development of the central nervous system as major brain damage, dysraphia of the face or spina bifida, polydactylism, absence of limbs or serious defects in their development, rectal stenosis, mongolism and multiple birth defects.

The incidence of birth defects have increased in Belarus in a direct proportion to the contamination by Cs - 137 in the regions, where the mother was living during her pregnancy [36]. Rates of birth defects of probable dominant genetic origin, e.g. polydactylism and multiple deformities, compatible with survival, have considerably increased [37]. Deformities probably caused by the teratogenic property of radionuclides are also increasing.

There is practically no region spared from radioactive contamination in Belarus, as 90 % of the contamination is caused by the ingestion of contaminated food. No region of the country can be considered as a control area. That is why the findings registered from 1982 to 1985, constitute the best control data available.

During the WHO conference of November 1995, Dr. Smolnikova from Gomel, in charge of the health of 46 thousand children living in an area contaminated by 40 Curies of Cs-137/km<sup>2</sup>, had already mentioned a high perinatal death-rate and an alarming increase of birth defects in the region [6].

Despite all these reports, the experts from IAEA denied in 1996 any increase of birth defects, related to the Chernobyl catastrophe.

After the epidemic of birth defects caused in Europe by the drug thalidomide (Contergan), and in spite of the fact that thalidomide is not mutagenic, the pharmaceutical industry was forced to exclude, all over the world, substances with mutagenic and teratogenic properties. The fact that similar measures do not apply to the nuclear industry may well be connected with the Agreement signed between the IAEA and other UN organizations, including the WHO. The radionuclides



released in the environment by this industry, have mutagenic, teratogenic or cancerogenic properties.

### **The destruction of scientific structures in Belarus**

As long as the World Health Assembly, the governing body of the WHO, does not amend the Agreement, concluded in 1959 with the IAEA, which holds it hostage to the nuclear lobby with regard to the radiation induced health effects, there is no hope for independent research groups to receive any substantial support.

The most efficient structures that study in Belarus the health consequences of the Chernobyl accident are being progressively dismantled.

Professor Nesterenko was one of the physicists, who came immediately to the place of the accident. As an expert and, sometimes, he acted as a fireman, flying with a helicopter within the radioactive cloud, pouring containers of liquid nitrogen in the burning reactor. It is incredible that he survived. The three other passengers of that helicopter have died owing to the irradiation. Together with his colleagues, Nesterenko established the map of the radioactive contamination of all the territory and formulated proposals for the protection of the people.

He continued his work, until his data and his recommendations were considered as unsatisfactory, he was considered as an <sup>3</sup>alarmist<sup>2</sup> and lost his Institute, his functions and his sources of income. Due to the help of Alex Adamovich, Andrej Sakharov, the chess champion Karpov, the Foundation for Peace, the Northern Ireland Foundation Ady Roche, and others, Nesterenko founded a state-independent research Institute <sup>3</sup>Belrad<sup>2</sup>, which works to assist victims of Chernobyl, teaching them the best possible methods of self-defense, when they are forced to live in contaminated territories, and tries to rehabilitate children.

The Minister of Health, Dr. Dobrishevskaya, who supported the most efficient research groups in this field, according to a joint report published in 1996 [24], was also not maintained in her function.

Professor Okeanov witnessed the same disorganization of the research structure he was in charge. It was a most valuable instrument, aimed at revealing the true dimensions of the epidemic of cancer diseases caused by the Chernobyl accident. The coincidence with his reports at the conference of the WHO (1995), the NGO conference in Minsk (1996), and his non-observance of the required silence at the conference of the IAEA in Vienna (1996), shows clearly who wanted get rid or to achieve the destruction of this working instrument.

The removal of Professor Bandazhevsky is the last strike in this destructive series. This pioneer of research of health consequences of the Chernobyl accident has revealed the mechanisms of the action of chronic low dose radiation by incorporated radionuclides in organisms: after iodide-131, Cs-137 and Sr-90. With his group of young researchers from the Gomel Medical Institute and numerous volunteers, Bandazhevsky has described typical diseases occurring in a large proportion of the population and almost all the children living in the highly contaminated regions.

These systematic and repeated strikes, which negatively influence the wellbeing of the country and its population, are, sometimes supported by western scientists perhaps jealous these

discoveries. However, those who gain the greatest satisfaction and benefit of such actions, are the richest countries with the most advanced nuclear industry, and the nuclear lobby

It is necessary that the WHO recover its independence, in order to be able to act again in this field according to its Constitution. Epidemiological research should start without delay. Who will study the genetic damages in children in the five coming generations? Who will devote himself to the rehabilitation of the victims, to their treatment and to the most effective protection of children and pregnant women? Rich nuclear states should come to the aid of victims of Chernobyl in Belarus and in other suffering countries.

It is also necessary to remove the present mandate of the IAEA to promote commercial nuclear industry. This Agency has much more important problems to solve: to keep under surveillance plutonium, uranium and all the fissionable materials, from dismantled nuclear warheads, military and commercial nuclear facilities. The IAEA must also control the problems of the safe storage of the radioactive waste, which humanity managed to produce in only two generations, since the beginning of nuclear age. This surveillance must unfortunately continue for centuries and millenaries.

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