

EDUCATIONAL CHALLENGES IN THE POST-CHERNOBYL YEARS

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The hazards involved in the use of imperfect technologies were realised by humankind only when the over-concentration of power production and power-intensive industries came into conflict with the quality of life. Eliminating the smog, which was common in big cities, improving the ecology of the Great Lakes, reconsidering the effect of chemical additives used in agro-industry, as well as the rigid restrictions placed on the internal combustion engine, can serve as striking examples of a new approach to environmental problems.

It is hardly surprising that costly ecological programmes are most successfully carried out in the developed countries. However, severe anthropogenic cataclysms know no frontiers and, in this respect, the geographical non-uniformity of the distribution of technological culture is becoming more and more of a hazard. There are only two ways of preserving world ecological stability and bringing applied approaches up to a safe level. One is by struggling against global environmental pollution nationally or, another way, is by providing preventive assistance for the less developed countries and bringing the technologies to them. However, the relative economic advantages of either approach does not seem to be so obvious.

Strange as it may seem, international experience in the field of radioecology is not adequate, in spite of systematic studies completed at considerable cost. The so-called "small dose range" (i.e. background exposure of 0.5-1Gy), as it is of public rather than military concern, has not yet been defined by risk coefficients. The large scale consequences of accidents remain the subject of bitter discussions between scientists, power producers and politicians, who represent various social groups. This controversy is still in full swing and apparently will not end until true information is obtained, provided that a similar or even worse accident does not happen again.

The emission of Strontium-90, in 1957 in the South Urals, has remained an internal matter for the Soviet Union. However, the Chernobyl accident in 1986 occurred at the geographic centre of a highly-populated Europe and gave rise to a number of challenging problems, the importance of which for the world population can hardly be exaggerated, and the solution of which is not likely to be found by the end of the century. It was inevitable that the most acute consequences were felt at the epicentre of the event.

Soviet nuclear weapons were developed and created under the control of the KGB. The Soviet nuclear power industry turned out to be a direct continuation of the military reactor-construction technology. The Chernobyl type RMBK uranium-graphite reactors, used to generate weapon-grade plutonium, remained secret and were scarcely safe to use. Therefore, from the moment of the explosion at Unit 4 of the Chernobyl NPP, the liquidation and study of the consequences of the accident were carried out by KGB methods, in which all results were kept secret. The post-Chernobyl situation has come into conflict with the declared principles of an open society and has finally led to actual political changes in the Soviet Union. The secession of Belarus and the Ukraine from the USSR was carried out under the Chernobyl banner.

The Communist regime proved incapable of protecting the population from the danger of radiation. The new government structures of the independent states could not cope with the problem either. As a result of stormy parliamentary activity in Belarus, the Ukrainian and Russian laws have been adopted for the social protection of the population affected by the Chernobyl accident. Now, after 8 years, it has become clear that the laws, although developed with the best intentions, have proved to be dilatory and expensive, incapable of solving the social problems.

The legally-established compensation for the population, which varied according to contamination has become an incentive for people to migrate to the contaminated areas, which has in turn led to a flow of complaints from other people. Since the lowest compensation value was assigned at the level of 37 kBq/sq.m, the majority of the population has been involved in the competition. Incidentally, the average natural content of the potassium-40 in the soils of Belarus, as well as for the whole of the planet, is about 100 kBq/sq.m. At present the basic features of post-Chernobyl Belarus are as follows:

Today the loss of interest in the problem among members of the Parliament has become evident. The laws with regard to social consequences have been carried under their own momentum, without rhyme or reason. Relocated people have not adapted to their new conditions and, one by one, have returned to their old places. of residence. There are many refugees from other CIS countries who have occupied abandoned houses in the contaminated areas. Generally, there has been a very dangerous indifference exhibited to the radiation and an ignorance of very simple protective measures shown by people. Today, a concept, based on effective doses rather than levels of surface contamination, is under consideration by government authorities. That part of the population which has already become used to compensation, is opposing such a concept. The problem has become all the more acute in recent months in Belarus, which shows no improvement in the national economy, and a rapid worsening of living standards. The existing compensation system is also being supported by members of parliament of the electoral districts in the contaminated zones, as they are bound by their election promises.

The most civilised way to solve these problems would be to provide a substantial once-only financial compensation for people affected by the accident. This would allow them to take their destiny into their own hands, and release the State budget from a long-lasting strain. Unfortunately, the time for such a decision has passed and now, its realisation will require the solution of many new problems, with regard to public opinion and the privileges already provided, which now have to be taken into consideration. It can be stated that the social problems resulting from Chernobyl came from a dilatory attempt to solve them. In this context, social tension can be lessened only by disseminating radioecological knowledge among the population and training professionals to work with government structures.

Economic Consequences and Scientific Aspects of the Public Health Problem

The quality of life, or to be more exact, of public health, reflecting the extent of the effects of radiation, is believed to be the ultimate criterion of an unfavourable radioecological state. This particular aspect is extremely unfavourable in Belarus: mortality has increased, the birth rate, on the other hand has gone down, and in general, the last 2-3 years have shown a decrease in population. In 1993 the Belarus population, totalling about 10 million, had increased by only 20,000 people, who were mostly refugees from the Caucasus and other areas hostile to the former USSR.

Table 1

Year	1986	1987	1988	1989	1990	1991	1992	1993	1994
Cases	2	2	3	6	27	57	68	92	60

Practically all diseases are progressively increasing, including those of cancerous groups. The state of child health is of particular concern; only 6 to 10% of children in the Republic can be considered as having a satisfactory health levels, whereas one third have considerable abnormalities. In comparison to 1985, the number of hypothyroidism cases in Belarus has doubled: an increase in the number of thyroid gland hyperplasia cases (first and second degree), was also observed, with 50 to 72% of all the child population in the southern regions in Gomel Province. The increase in thyroid gland cancers is evidently associated with the Chernobyl iodine release. The previous two decades showed only two thyroid cancer cases per year in children aged under 14. Since the Chernobyl accident the number has been rising consistently. Table 1 shows the sharp increase in numbers of thyroid cancer cases which have been observed for the three years since the accident and is still continuing. For children conceived after 1986, the statistics show the same values as before 1986. A similar situation is observed in the Ukraine. With regard to other diseases, this dependence is not so unequivocal. Health indices are subjects for political speculation, where extreme statements are very frequently made, with radiation being blamed or not being blamed, depending on the current political benefit to be gained. Such a complicated situation can hardly be analysed clearly for the following reasons:

- The main part of the dose was formed during the first 2-3 weeks after the accident. As a result of the iodine component, the whole population of Belarus has been affected with radiation, to a larger or smaller extent. The dissemination of contaminated food products via the trade network, in its turn, contributed to levelling out the effective dose. Therefore, in order to carry out a classic analysis of radiation, the appropriate population groups could hardly be specified.
- The time series analysis, used for isolating radiation effects, did not seem to be correct. The state and level of epidemiological studies was extremely unsatisfactory, in both Belarus and the former USSR. The data obtained was top secret and misinterpreted; the lack of examination standards and skilled physicians in the outlying districts contributed to the unfavourable situation as a whole. The increase in practically all diseases is often associated with an improvement in diagnostic techniques.
- The quality of life was greatly affected by the obvious stress phenomena, though estimating these quantitatively is still difficult.
- The drastic and negative changes in living standards because of the economic crisis have reduced a large part of the population to the survival threshold, forcing people to change their traditional diets and consume cheaper, low grade food. Unfortunately, such an obvious reason is unlikely to be quantifiable at present. This presents a complex study, though the negative influence caused by dietetic changes seems to be clear.
- These factors make isolating the share played by the radiation component, a far from simple problem. More so, as the case in point, is the risk factor, which is now lost in the statistic uproar. In this context, the controversies over the medical consequences of the Chernobyl accident can hardly be resolved at present.
- Therefore, relying rather upon experience and intuition than trying to apply quantitative justifications, the reasons for the continuing deterioration of public health can be in the following order of decreasing importance:
 1. social instability and stress phenomena (People have no confidence in their future and no opportunity to protect their savings, to provide care for their children and themselves.)
 2. economic crisis (changes in diet, worsening of food quality and living standards)

3. unfavourable ecological conditions, in general (low-quality water, over-load of pesticides, nitrites and other deleterious matter in food products, air pollution and the lack of monitoring)
4. unfavourable radioecological situation, which probably in conjunction with the factors mentioned above, is resulting in a synergetic effect

Education

Now, after an eight year lapse, it is quite clear that these numerous unthinking and rash decisions, faults and blunders, wasted expense, fears and social opposition within society, might have been avoided if the State protection measures, as well as personal radiation protection, (which was partially successful!), had been carried out by experts and specialists and in accordance with known and simple regulations, rather than by non-experts. The level of education on radiation safety among the population leaves much to be desired and the cost of protection activities, on the part of the State, is a burden on the limited budget of Belarus, which suffered much more from the Chernobyl disaster than other Republics.

At present, a network of short-term schools has been established to train specialists in dosimetry and radiometry; a new discipline, Radiation Protection, has been introduced into secondary school and higher education curricula. However, this subject is taught mostly by lecturers and teachers without special training themselves, who use popular newspaper materials because of the lack of special textbooks. In fact, such textbooks have now been developed at the ISCR. Having recently been edited, they are finally available at the College.

Realising the importance of the role of specialists, in coping with the consequences of accidents, the First International Congress in Memory of A. Sakharov held in Moscow, 1991, recommended that the heads of governments concerned should open, in Russia, the Ukraine and Belarus, higher education schools on radiation accidents and use the Chernobyl experience to train professionals, to involve them further in making decisions which would lessen the consequences of accidents. They should also disseminate radioecological knowledge among the population, thereby reducing deleterious health effects by encouraging people to make use of personal protective skills and measures, and lessening the radiophobia which exists. Unfortunately, this idea has been realised so far only in Belarus. January 1992 saw the opening of the International Sakharov College of Radio-ecology (ISCR) by decree of the Belarus government, which followed the recommendations of the Sakharov Congress. Some explanations are appropriate here: first, this is not a college in the Western sense, but rather a university carrying out a 6-year academic programme; second, in addition to the departments of Ecology and Agrobiology in the contaminated zones, there are also departments of Nuclear Physics and Radiochemistry, Radiobiology, Nuclear and Radiation Medicine which, along with extensive courses on Mathematics, Computer Simulation and Electronics, Humanities and other disciplines, cover the whole range of problems to be encountered by experts when dealing with prevention or the consequences of severe or even minor nuclear accidents and minor incidents. The College is in its third year and, at present, is open to applicants from Belarus, the Ukraine, Russia and the Baltic States. The admission of Western applicants will commence in 1995.

Invaluable assistance in the creation of the new university was rendered by the International Advisory Committee, headed by Professor Richard Wilson, of Harvard University. The Committee is comprised of well-known scientists and public figures including Elena Bonner the President of the Sakharov Foundation. With the approval and support of the Advisory Committee, promising inter-university links, as well as important academic and scientific projects, have been established and are currently under way. Presently, a joint team of professors, scientists and students from the College, the Ukraine, Great Britain and the US are working together at the ISCR Field Station in the vicinity of a 30-km exclusion zone.

The double supervision of individual academic programmes is practised for ISCR students, involving lecturers and professors from Kingston University, UK, and the Picardie University, Amiens, France. Expansion is planned for the IPSN, Gustav-Roussey Institute and Pittsburgh University, US. Much is expected from the UNESCO Chair of Environmental Sciences and Management, which was formally established at the College. On the eve of Andrei Sakharov's birthday in May 1994, the Advisory Committee discussed the new academic programmes, the transfer to a modular scheme, pioneered by the College in the former Soviet Union and possible ways of solving the major problems that have to be resolved urgently in order to preserve the concept of the Sakharov College in Belarus, a State which is suffering a tremendous political and economic crisis. These requirements are as follows:

- the establishment of an academic and scientific library with regular provision of scientific information
- the provision of ISCR training laboratories with adequate and modern equipment
- funding to attract the best lecturers to deliver courses tailored to the students and also fund student and scientist-lecturer exchanges
- financial means to reconstruct the college building and field station, as well as to build the student hostel and a small hotel for visiting lecturers

International Advisory Committee Ministry of Education of the Republic of Belarus

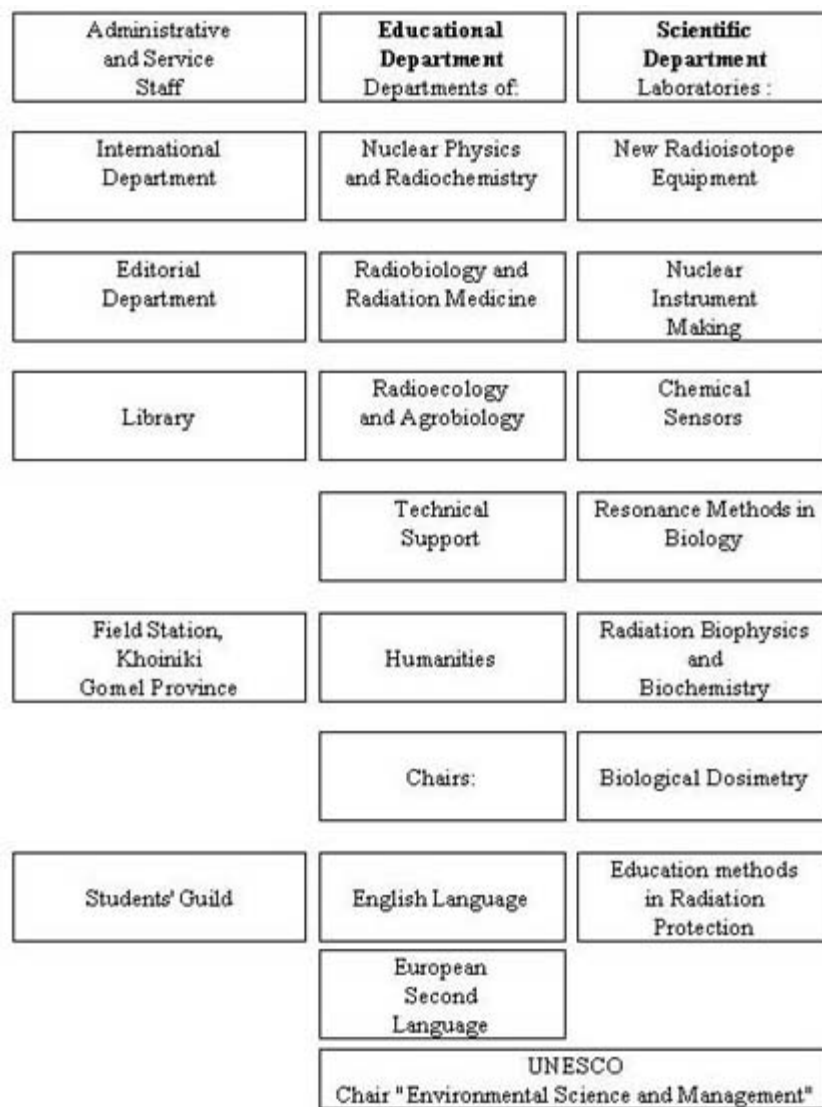


Figure 1. Structure of the International Sakharov College on Radioecology

These problems will require up to US \$3 million, over the next five years. This figure has been mentioned as the Western contribution to the United Nations Project G-02 International Sakharov College on Radioecology. Although this was approved, it still remained just a "project."

It is difficult to believe that supporting this important idea, in memory of Andrei Sakharov, has failed to raise this relatively small amount of money. Power-producing companies could be potentially interested partners, if they revised their power strategy in the direction of ecology and environmental education. In this respect the International Sakharov College is governed by the principle of scientific knowledge and therefore, being an independent institution trusted by the population, is not involved in politics. It could therefore be used by such companies as an organisation to disseminate serious and reliable information in the field.

It is common knowledge that the history and culture, as well as the future, of any country is determined by a small but active stratum of people, constituting its scientific intellect. Sociologists claim this is approximately 2% of the population. In Belarus, located as it is at the cross-roads of major world events after the wars, waves of emigration and Stalin's purges, this stratum has become extremely thin. This might be the reason why the new reforms are being carried out with so much strain and difficulty and the country, as a whole, currently resembles the old system reserve. It is all the more regrettable that Belarus is also located at the cross-roads of European interests.

This situation can be changed only if new, free-thinking and educated young scientists, statesmen, political and public figures make their appearance. To serve the needs of such people, the older generation has been gathered at the Sakharov College to pass on its knowledge and experience to a new Belarus elite. The path of education is not the easiest or most rapid one, but it is reliable, and will securely provide the country with highly skilled professionals as well as statesmen.

Dr. **Alexander M. Lutsko** was Rector of the International Sakharov College of Radioecology, Minsk, Belarus, from 1992 to 1997. A graduate of Belarus State University, he had over thirty years of scientific experience, including twenty four years of lecturing experience. In his specialisation, the field of nuclear physics, he contributed numerous papers and inventions, and published books and textbooks. Alexander Lutsko passed away September 4, 1997.