TA 8: INCIDENTS AND ACCIDENTS

IMPLEMENTATION OF AN INCLUSIVE RADIATION MONITORING SYSTEM IN THE BRAGIN DISTRICT IN BELARUS

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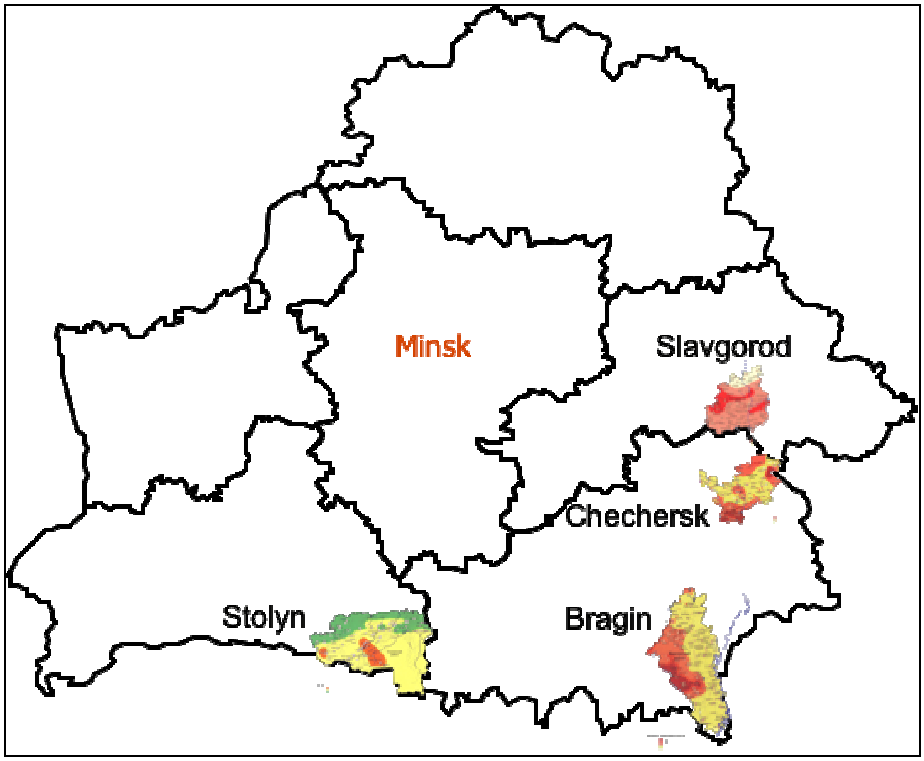
1. INTRODUCTION

This paper presents results from one of the projects developed within the general framework of the international Programme "CORE" (Cooperation for Rehabilitation in Belarus). The overall objective of the programme is to make sustainable improvements to the living conditions of the inhabitants of the territories affected by the Chernobyl disaster. The CORE Programme is currently developed in four contaminated districts of Belarus (Bragin, Cherchersk, Slavgorod and Stolyn - figure 1) in the following four areas: economic and social development; health care and surveillance; education and culture; and radiological quality [1]. The project that is presented here refers specifically to the field of "radiological quality" and will last until the end of 2008.

Figure 1. Location of the four districts involved in the CORE Programme in Belarus



The project named "Implementation of an inclusive radiation monitoring system" was launched in April 2004 in the Bragin district, which is one of the

most contaminated areas in Belarus. It is located in the very South East of the country and is adjacent to the 30 km exclusion zone around the Chernobyl nuclear power plant (zone with caesium-137 soil contamination above 1480 kBq/m^2). Since the accident, the number of people living in the district has declined by 56%. Today, 17000 persons, including 3000 children, live there in mostly rural areas where ^{137}Cs levels in soil are between 185 and 555 kBq/m^2.

The project aims at diffusing a practical radiation protection culture, among the population, and especially among children, through the development of a radiation monitoring system handled by the local professionals and the population. The adopted approach is mainly based on the experience of the ETHOS Project implemented in Belarus between 1996 and 2001. Indeed the ETHOS Project revealed that an efficient monitoring system and the involvement of the local population and professionals in the day-to-day management of the radioactive contamination of their environment are key elements in the process of rehabilitation of living conditions in the affected territories [2,3]. One peculiarity of the project developed in the Bragin district is that it is locally co-ordinated by the inhabitants themselves through a local non-governmental organization (NGO) named "Sprout of Life". This NGO was created in 2003 and now gathers about 20 volunteers: mothers, health professionals or professionals in the field of education. CEPN ensures the general coordination of the project.

2. PREPARATION PHASE

Initially, this project was proposed as a complementary element of the "Mother and Child" project that was in course in the Bragin district and whose general objective was to support and build up primary health care structures in the field of mother and child health. This project was led by a local NGO "Sprout of Life" whose participants expressed the wish to benefit from radiation monitoring coverage. Indeed, in 2002, in the Bragin district, there was no more equipment to measure the level of internal contamination and only four localities had obsolete radiameters to measure the levels of contamination in foodstuffs. The project was consequently launched to implement an operational radiation monitoring system so that people can regain control on their radiological situation and the local NGO can address health issues.

The preparation missions took place between July 2002 and October 2003. Meetings with local authorities, responsible of the Bragin hospital as well as meetings with many villagers and teachers in schools confirmed the interest of local stakeholders in the improvement of the radiation monitoring arrangements. Contacts were taken with the existing NGO "Sprout of Life" that accepted to coordinate the project at the local level. Taking into account the lack of experience in Belarus as far as NGO practice is concerned, it was then decided to look for a French NGO operating in the same domain i.e. radiation monitoring of the environment and foodstuffs and information of the population to establish a partnership. By the end of the year, ACRO accepted to play this role.

At the beginning of 2004, the detailed project was prepared and the Swiss Agency for Development and Cooperation (SDC) accepted to support it [4].

The project started in February 2004 with a launching seminar. The partners of the projects, together with the local professionals, authorities and representatives of the population discussed the objectives of the project and evaluated the alternative approaches to achieve them. As part of this Seminar was also included a detailed presentation of the ETHOS experience with the support of a video film and the testimonies of local professionals from the Stolyn district as well as researchers from the BB-RIR Institute who participated directly in the development of the ETHOS experience.

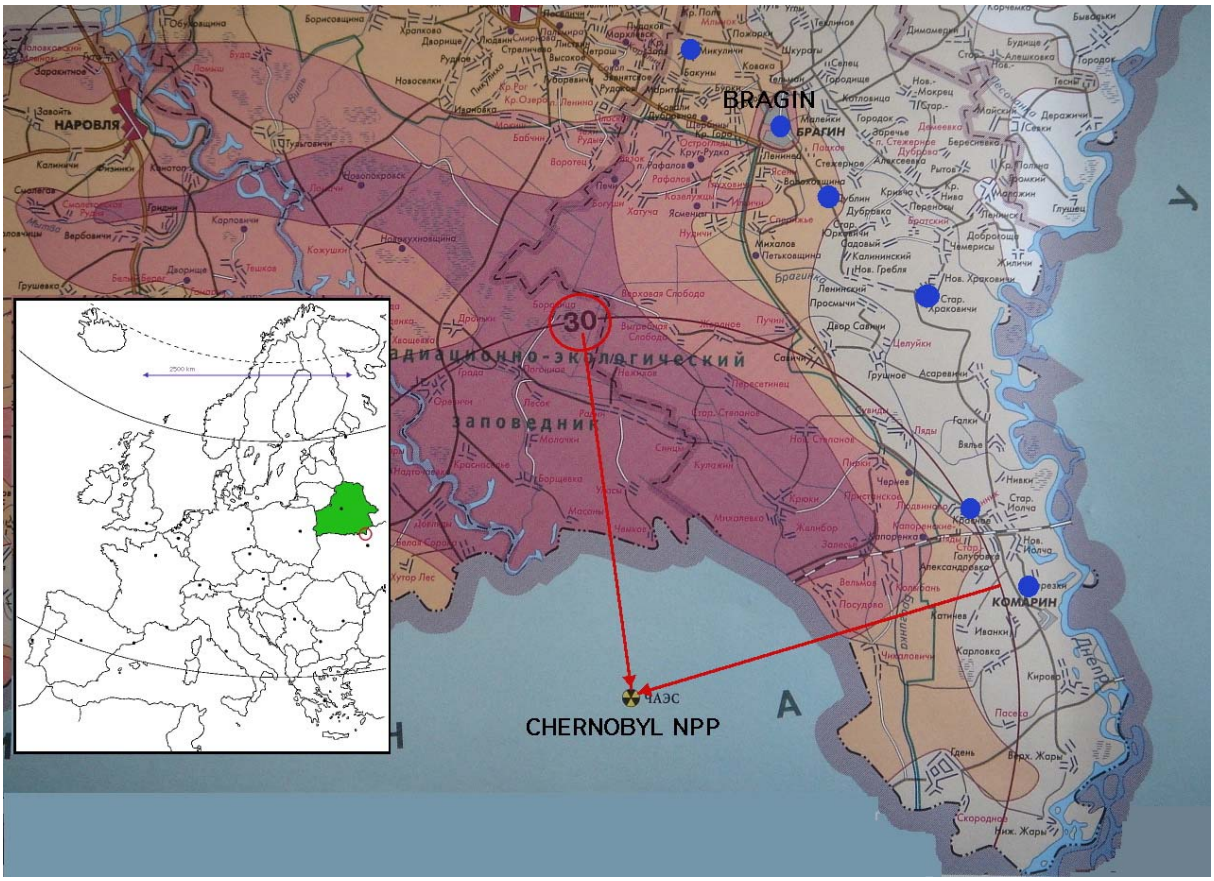
3. IMPLEMENTATION OF THE PROJECT

From April 2004, the monitoring equipments and facilities of the Bragin district have been significantly modernised and extended. A network of stakeholders has been progressively constituted. They operate an efficient monitoring system and focus their efforts on measurements and reduction of the caesium-137 contamination in the district.

3.1. Implementation of Local Centres for Radiological Control (LCRCs)

Between April 2004 and November 2004, six Local Centres of Radiological Control (LCRCs) have been installed or renewed in the localities of Bragin (in the Centre for Epidemiology, Hygiene and Public Health), Dublin (in the school), Komarin (in the veterinary centre), Krakhavitchi (in the school), Krasnoye (in the dispensary) and Mikulitchi (in the school) (figure 2).

Figure 2. The Bragin district and the localities involved in the project



Each centre was equipped with a gamma spectrometer to provide a rapid assessment of the caesium-137 concentration in foodstuffs, an electronic dosimeter to provide measurements of ambient dose rates, a computer and a printer (figure 3).

Figure 3. The local centre of radiological control of Mikulitchi

Local volunteers have been trained to become "radiametrists": an employee of the Bragin Centre for Hygiene, Epidemiology and Public Health, a teacher of the Dublin school, a veterinarian of the Komarin veterinary centre, the librarian of the Krakhavitchi school, a former liquidator in Krasnoye and an employee of the arts and culture centre in Mikulitchi. They are not technicians or health physicists; they undertake their normal jobs in addition to their role as radiametrists. They monitor the contamination levels in foodstuffs by carrying out at least 30 measurements per month.

In the following tables, the results of some measurements performed in the centres of Krasnoye and Dublin are presented. The Belarus limits of contamination of foodstuffs in caesium-137 are included for comparative purpose.

Table 1. Results of foodstuffs measurements performed in Krasnoye during the first year of the project (April 2004 - April 2005)

Product	*Number of measurements*	*Maximum value (Bq/kg,L)*	*Mean value (Bq/kg,L)*	*Belarus limit (Bq/kg,L)*
Milk	*66*	*165*	*26*	*100*
Mushrooms	*32*	*6572*	*1440*	*370*
Potatoes	*58*	*29*	*2*	*80*

Table 2. Examples of foodstuffs measurements performed in Dublin in January and February 2006

Product	*Measured value (Bq/kg,L)*	*Belarus limit (Bq/kg,L)*
Milk	*330*	*100*
Milk	*63*	*100*
Milk	*288*	*100*
Milk	*< 18*	*100*
Milk	*85*	*100*
Hay	*3800*	*1300*
Hay	*1800*	*1300*
Hay	*480*	*1300*
Hay	*4530*	*1300*
Mushrooms	*13600*	*370*
Potatoes	*< 18*	*80*
Game	*4700*	*370*

The most sensitive foodstuffs are dairy products and meat; contamination levels of these products directly depend on the level of contamination of winter fodder and summer pastures. Berries and mushrooms are often very contaminated as well.

In the project, one of the objectives of the radiametrists is to benefit from a global overview of the radiological situation of their village. It is for instance important to have a good knowledge of levels of contamination of hay and pastures around the village to be able to interpret levels of contamination of milk.

Thus, for example, in Dublin, when the radiametrist observed a general increase in the level of contamination of milk of private producers in the beginning of the year 2006, he immediately contacted them and measured samples of hays they used to feed their cow (table 2). He also discovered that the field where hays were mowed was highly contaminated and recommended them to change their feeding stuffs. In a further step, these results could be used to work with the local authorities to identify fields and pastures that need to be improved through agricultural countermeasures.

3.2. Whole body monitoring

End of 2005, four whole body monitoring campaigns (2500 measurements per campaign) have been already carried out in the schools and kindergartens of the district by the BELRAD Institute. They took place in April and November 2004, April and October 2005.

The whole body monitor (figure 4) comprises of a seat equipped with a detector (sodium iodide crystal). Measurements of caesium levels in the body

take about five minutes. The child, on whom the measurement has been made, leaves with the result and a short description of its significance. The whole body monitoring equipment (seat and computer) is moved from school to school to limit the movement of children and to ensure that people living in most parts of the district are assessed.

Figure 4. Whole body measurement of a child in the school of Krasnoye

Results of whole body measurements are essential to assess the radiological situation of a person or of a locality in which they live. On the basis of the results of the measurements, the most severely contaminated children are identified and work begins, with their families, to determine the sources of the contamination. This work is carried out locally by the non-governmental organization "Sprout of Life" together with the radiametrits, which, with the parents and teachers, identify the scope for practically reducing the intake of caesium by the children. In particular, the radiametrists visit the families to discuss their dietary habits so that they can find products that are likely to be the main contributors to the level of contamination and measure them.

In May 2005, the Chernobyl Committee of Belarus equipped the Bragin hospital and the Komarin polyclinic with a fixed whole body counter. These equipments also completed the implemented monitoring system and the actors of the project work, from now on, in close cooperation with the representatives of these two health bodies. Thus, when the operators of the fixed whole body counters identified a person who is highly contaminated, they contact the Bragin Centre of Hygiene, Epidemiology and Public Health that launches a "survey" similar to the one described above. In most cases, they work with the radiametrist of the village from which the person comes.

Mushrooms, berries or game are often the main sources of high levels of internal contamination, especially during Autumn (i.e. episodic ingestion). Nevertheless, daily ingestion of smaller quantities of caesium can also explain some of the high whole body monitoring results (i.e. chronic ingestion).

For example, if a whole body measurement is about 2000 Bq, several scenarios are possible. The source of the contamination could be due to:

- *A single ingestion of 200 grams of mushrooms with caesium levels of 10,000 Bq/kg a few days before the measurement,*
- *A daily ingestion of half a litre of milk with caesium levels of 80 Bq/kg, or*
- *Combinations of episodic and daily ingestions.*

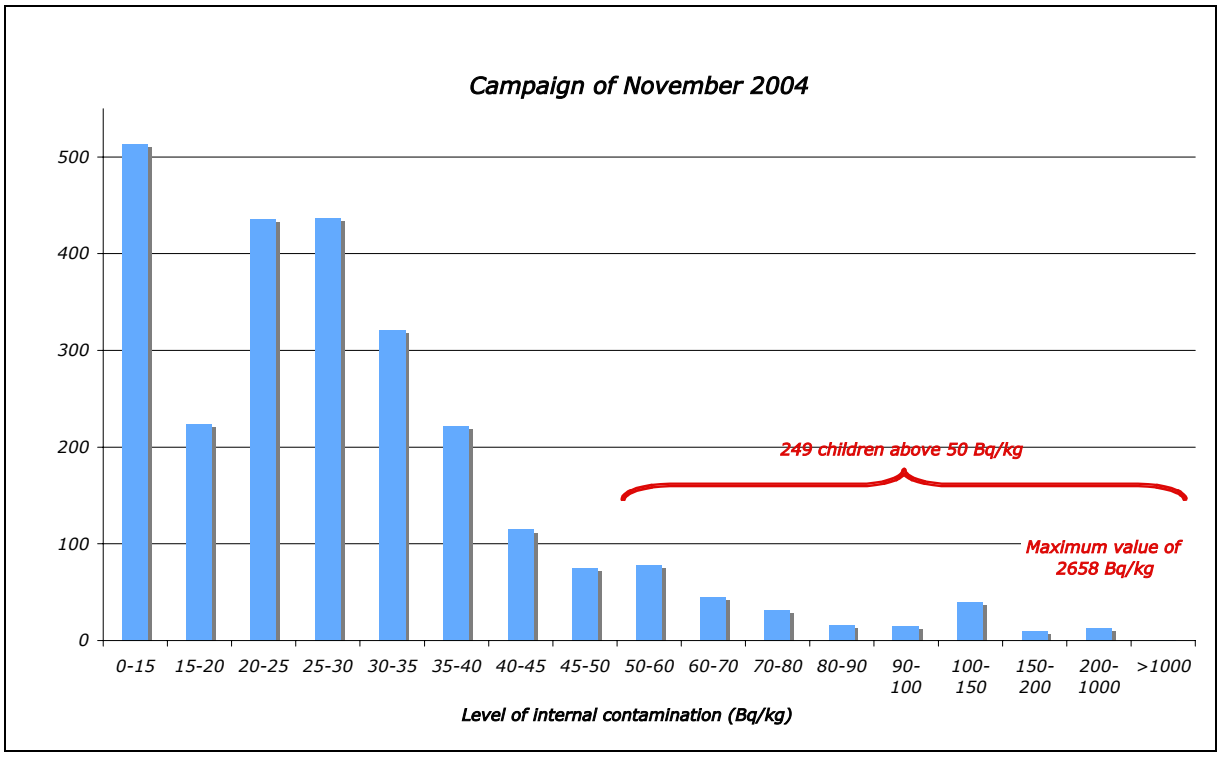
The establishment of a dialogue between the family, the members of Sprout of Life and the radiametrists is the only way to interpret measurements and to identify the causes and roots of the observed contamination (chronic and/or episodic ingestions).

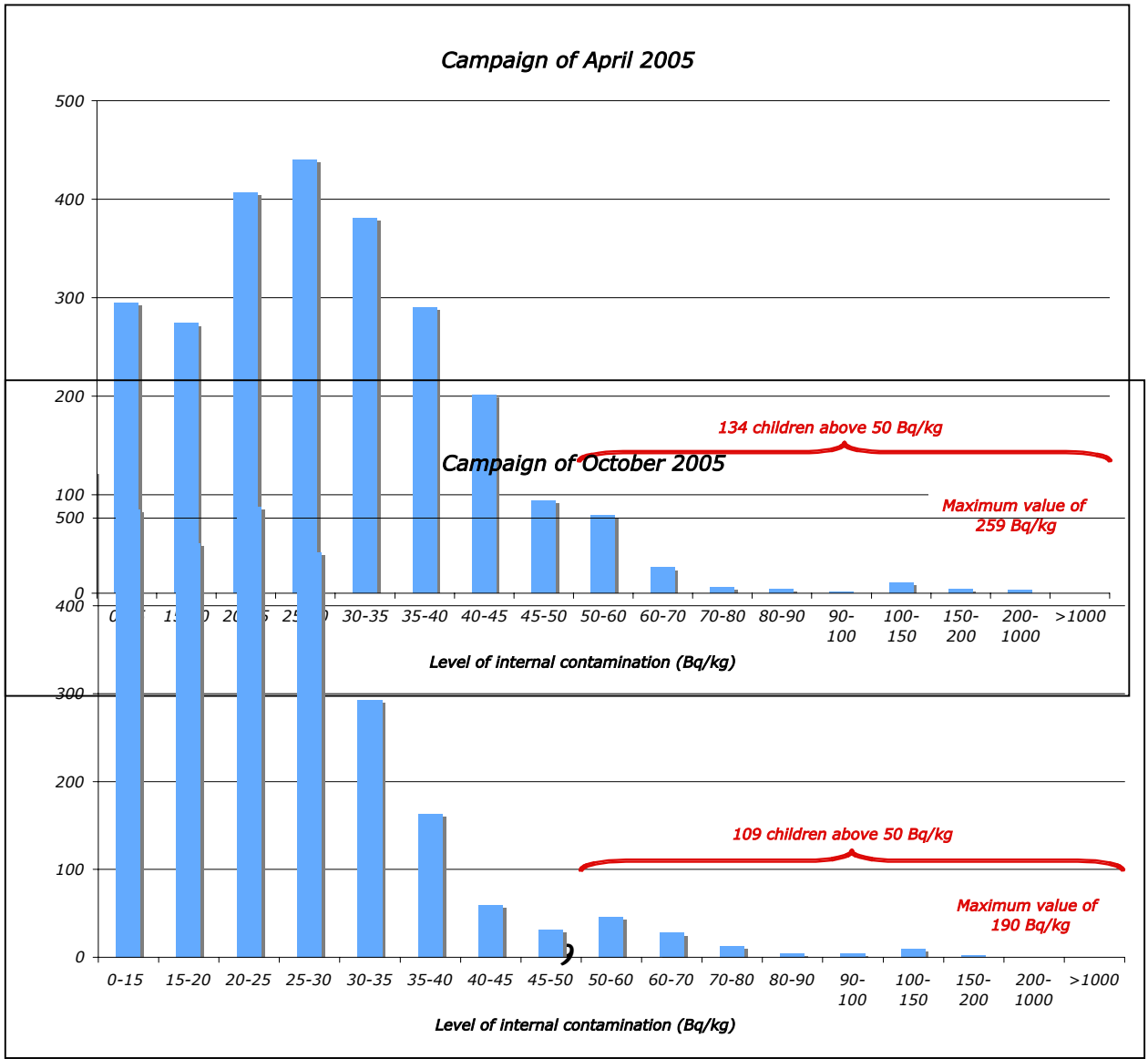
The monitoring system of the internal level of contamination will be soon completed by the set up of a mobile whole body counter in the Bragin hospital. This will allow covering the whole district, above all adult people who cannot move to Bragin or Komarin.

4. RESULTS AND PERSPECTIVES

The results of the last three whole body measurements campaigns performed in the schools of the district are quite encouraging. From the beginning of the project, the maximum internal contamination value has fallen more than tenfold (from 2670 Bq/kg to 260 Bq/kg) and the average value has dropped from 30 to 24 Bq/kg. Since April 2005, efforts of local health professionals, members of Sprout of Life and radiametrists are focused on children who have a level of internal contamination above 50 Bq/kg. The results of the last campaign performed in Fall 2005 show that the number of children whose level of contamination is between 50 and 70 Bq/kg has slightly decreased. More than 95% of children of the district had a level of contamination below 50 Bq/kg (75% below 30 Bq/kg) after the last campaign of measurements (figure 5).

Figure 5. Results of the last three whole body measurements campaigns performed in November 2004, April and October 2005.


Campaign of November 2004
500
400
300
200
100
0
249 children above 50 Bq/kg
Maximum value of 2658 Bq/kg
0-15
15-20
20-25
25-30
30-35
35-40
40-45
45-50
50-60
60-70
70-80
80-90
90-100
100-150
150-200
200-1000
>1000
Level of internal contamination (Bq/kg)


Campaign of April 2005
500
400
300
200
100
0
134 children above 50 Bq/kg
Maximum value of 259 Bq/kg
30-35
35-40
40-45
45-50
50-60
60-70
70-80
80-90
90-100
100-150
150-200
200-1000
>1000
Level of internal contamination (Bq/kg)
Campaign of October 2005
300
200
100
0
109 children above 50 Bq/kg
Maximum value of 190 Bq/kg
0-15
15-20
20-25
25-30
30-35
35-40
40-45
45-50
50-60
60-70
70-80
80-90
90-100
100-150
150-200
200-1000
>1000
Level of internal contamination (Bq/kg)

All this intends to show that the approach developed with the local professionals and the population is effective.

In addition to the actions undertaken with individuals or families, the radiametrists or the members of Sprout of Life can also work in a collective perspective (see §3.1,where the radiametrist is able to contact the kolkhoze of his locality to identify together pastures that need to be improved). In that case, the roles of CEPN and ACRO consist in favouring the implementation of an efficient process of cooperation between all the local actors involved as well as in building interfaces between these local stakeholders and the relevant regional and/or national institutes. Exact needs of the populations living in contaminated territories can thus be relayed to local and/or national authorities so that they set up adapted means and countermeasures.

Beyond the implementation of an effective infrastructure to ensure a reliable radiation monitoring of the population, the objective of the project is also to develop a practical radiation protection culture among the population to allow each individual to adopt a preventive approach and cautious attitude with regard to the radiological situation. The development of such a culture particularly relies on education of children. In 2006, in Krakhavitchi and Dublin, a Pilot Study will be launched to test the possibility to implement "Radiation Protection Culture Groups" in schools dealing with the topic of "radiological quality". According to the results of this experience, this action could be extended to others schools. These groups would work in villages where there is already a Local Centre for Radiological Control. Relevant information on the radiological situation would consequently be available and the groups would be able to undertake concrete actions. The animators of these groups would complete the actions implemented by the members of "Sprout of Life" who organize lessons on radiation protection in schools and distribute widely brochures and posters on the topic.

Acknowledgement

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We also thank the partners of the project:

- *The Association pour le Contrôle de la Radioactivité dans l'Ouest (ACRO – French NGO)*
- *The Institute of Radiation Safety BELRAD (Belarus NGO)*
- *The Brest Branch of the Research Institute of Radiology (BB-RIR – Belarus)*

References

[1] CORE Annual Review, 2004
More detailed information on the CORE Programme and its activities projects and initiatives can be found at www.core-chernobyl.org

[2] ETHOS (2001) Réhabilitation des conditions de vie dans les territories contaminés par l'accident de Tchernobyl: la contribution de l'approche ETHOS, Actes du Séminaire International de Stolyn, Biélorussie, 15-16 novembre 2001, http://www.cepn.asso.fr/fr/ethos.html.

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[4] www.sdc.by