

## **Accidents in atomic industries and its consequences**

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The medical impact of Chernobyl, a major nuclear accident, remains a problem since 26 years. Kofi Annan, in a report of OCHA in 2000, indicates that there were at least 9 million irradiated victims, this figure will increase during the coming decades, with the new generation. Epidemiologists extrapolate that already one million of the victims died due to the radioactive contamination.

Representatives of the International Atomic Energy Agency (IAEA) and UNSCEAR claim at the United Nations Head Quarter, that there were 40 deaths due to radiation in the years following the Chernobyl explosion. These two UN institutions propagate that the main health problem encountered since April 26, 1986, are due to "radiophobia". A word created to exonerate the atomic industry. We should never forget that of the statutes of the IAEA makes clear that the principal objective of this powerful Agency, established on the top of the hierarchy of the United Nations, is to "accelerate the increase of the contribution of nuclear industry for peace, health and prosperity all over the world" (1).

With this obligation, the IAEA and several other representatives of the atomic lobby have to minimize or censor the pathological consequences for humanity due to artificial radionuclides. The word "radiophobia" was invented to explain the cause of all pathological damages provoked by ionizing radiation, and make the victims responsible for the health damages for them selves and their children.

As radiophobia does not affect wild animals, scientists and geneticists started studying the wild fauna, in particular in the 2044 square km of the exclusion zone around the collapsed Chernobyl reactor. In this evacuated area, wild animals encounter much less stress or fears, than elsewhere: Since 26 years, there is no hunting, no tourism, no circulation, no toxic pesticides from the agriculture, no exploitation of forests. Politicians consider that this zoological paradise should become an Attraction and National Park, with, in its center, the new Sarcophagus costing 1.6 billion dollars (considered by some experts useless regarding security).

- Scientists started studying wild rodents, looking for possible adaptation of bank voles to radiation. Pelevina showed the contrary: the rodents had an increased susceptibility for ionizing radiation since the so-called iodine shock, following the explosion. This increased susceptibility to ionizing radiation affected also more than 90 % of the children. It appeared as the contrary of an adaptation in the vast majority (2).

- Goncharova undertook a ten-year follow-up of the genetic damages among rodents in four different distances from Chernobyl. Major perigenetic alterations occurred at 30 km from Chernobyl, where the radioactivity for radiocesium, Cs-137 and Cs-134, was 2546 kBq/m<sup>2</sup>. But less important but comparable perigenetic damages were measured 300 km from the destroyed reactor. There, the contamination was 200 times lower than in the first place: only 12 kBq of radiocesium per square meter.

An important finding was not only the transmission of the genetic alterations to the following generations, but the continuous increase of the genetic disorders from one generation to the other, in all study areas. Some adaptation took place in the most contaminated place, where after 15 to 20 generations, a significant intrauterine mortality took place. In all the other studied rodent populations, the genomic instability increased, reaching after 10 years nearly the same level as in places with the highest irradiation (3).

- Ellegren from Sweden studied colonies of barn swallows in the exclusion zone, but also in a control area in Central Ukraine where the fallout was minimal. They published their findings in the scientific review Nature in 1997(4). When compared with swallows of radiologically clean areas, the population of the studied colonies decreased significantly, due to reduced fertility of males and sterility of 23 % of the females. There was an increased of the malformation-rate and of the mortality during the migration period. These controls required thousands of birds carrying numbered rings (4).

- A. P. Møller from the University of Paris Sud, and T. A. Mousseau, professor in the South Carolina University, USA, collaborating with several highly competent specialists, studied the diversity of the local fauna. 127 common birds were studied in the 2044 square km evacuated area since 1986. For each species the abundance in each observation point was registered. There were 731 observation points where the radio-contamination was precisely recorded by competent technologists, the observers did not know the level of contamination of the places where birds were determined and counted: a double blind study (5).

With increasing radioactivity, there was a constant decrease of the abundance of birds and a decrease of the biodiversity (number of breeding species in given habitats). The singing males determine the limits of each occupied territory. For many species, the continuous decline of the population would have led to the eradication of the species, for instance for barn swallows, if during the spring migration, foreign swallows would not have invaded the colonies. Based on specific protocols, Møller, Mousseau and collaborators studied also larger mammals, reptiles, frogs, and arthropods such as spiders and different insects such as butterflies and grasshoppers. For all species studied, when the sectors was more radioactive, a reduction of the number of animals was noticed, compared with less radioactive places (6, 7).

- These biologists deplore that comparable studies are not undertaken for human beings. However, the Ukrainian Embassy periodically communicates reports to the French government and the press, indicating the health problems of populations living close to Chernobyl. For instance, April 26, 2005, the

distributed document indicates that 3.5 millions of Ukrainians were irradiated, among these 1.3 million were children. 160999 citizen were evacuated. In this group 84.7 % are ill. The government indicates that among the citizen who remained in contaminated areas, 89.85 % are ill now. The follow-up on this population indicates that each year the proportion of ill persons increases. Among the 130000 Ukrainian liquidators, 94 % are invalid.

- Dubrova from the research unit of Jeffries, in Leicester U.K., found trans-generational transmission in irradiated humans in one generation in the Ukraine, in Chernobyl and in Semipalatinsk, and for up to three generations, in the Kazakh steppe, where shepherds were irradiated during the atmospheric atomic tests. The genetic damages were measurable in grand parents, parents and children (9, 10).

- The transmission and amplifications, explain the fact that the children of irradiated workers in atomic industries or victims of accidents such as Chernobyl, have greater risks of suffering from premature malignant tumors or other health problems than the father or genitors who do not need to suffer from clinical problems (11, 12).

#### The situation in Fukushima

- In 2011, Møller and Mousseau started working in Fukushima, starting to repeat the type of researches they made in Chernobyl. Recently, in 2012, they already reported their preliminary findings. These are comparable with the previous observations in the Ukraine. However, in Fukushima, it was too early to find genetic alterations in birds. These may appear in 2012, in the next generation.

Møller and Mousseau found a correlation between the reduction of the abundance of different bird species; also a reduction for butterflies they studied, when the measured radioactivity of the soil increased. Only for spiders, the correlation was not the same in Fukushima than in Chernobyl : the population increased with increasing radioactivity on the soil. This could possibly be due to the fact that preys were less fit because of the artificial radiations and therefore easier to capture. These measures will be repeated in the two coming years, as this team uses to do in Chernobyl (13).

- In 2011, a Japanese research team of 7 experts from the Ryukyu Academy studied the biological and genetic impact of the artificial radioactivity due to the Fukushima disaster in a butterfly species. August 9, 2012, they published their results in SCIENTIFIC REPORTS, which is depending of the publisher of NATURE (14).

The pale grass blue butterfly *Zizeeria maha* (Lycaenidae) is an indicator species to evaluate the environmental conditions. These butterflies common in all Japan, may be considered as useful environmental indicators. The wing color patterns are sensitive to environmental changes.

In March 2011, the larvae of these butterflies were overwintering, and irradiated by artificial radionuclides, externally and internally from ingested food. The first-voltine adults started flying two months after the nuclear

accident. The first 144 adults were apparently normal in their behavior, but small individual anomalies could be detected, in comparison with butterflies from clean regions. The male forewing size was reduced, this was negatively correlated with the ground radiation dose in some areas.

This team could study the two next generations, where F1 offsprings, showed more severe abnormalities than those found in May. Even more frequent changes were again found in the F2 generation, the adult butterflies collected in September 2011 showed more frequently and more severe abnormalities than the adults collected in May.

Similar abnormalities were experimentally reproduced in females from a contaminated area brought in contact with non-irradiated male butterflies, in clean environment. The genetic transmission of these anomalies was demonstrated.

As in chronically irradiated small wild mammals in Chernobyl, there is an increase of the anomalies from one generation to the next generation, even if the radioactivity is decreasing.

## Comments and proposals

The work of the Ryukyu team is a key trial. Hopefully this example will be followed by a lot of studies of similar quality, also involving the human population. It is somewhat upsetting to read that till now, not a single human death caused by radiation has occurred in Fukushima. Should one make such statements before any study has been undertaken nor even authorized?

- For such a claim, one needs demographic statistics to answer the question: is the Sex ratio (or sex-odds) unchanged in Fukushima since January 2012? One expects among lived births a loss of 4 to 8 % of the girls, compared with the number of lived boys.

- Since the end of 2011, did the perinatal mortality increase? This means death before day 28. Where are the figures?

These data are available in the Fukushima Prefecture, and do not need physicians to be studied by epidemiologists and mathematicians. These findings will be compared with those of 1990 to 2010 in the same communities. The differences could already be highly significant at the end of this year.

To determine the causes of death, physicians will have to start collaborating. Unfortunately, such researches apparently are not yet permitted. The increased genomic instability should be studied in children and in adults. The country would learn about the increase of still birth, of congenital malformations, especially Down's syndrome. Pediatricians, collaborating with hematologists and immunologists, could study in children the alterations of the immune system and their consequences: more infectious diseases, more chronic, severe and complicated infections, and autoimmune diseases, such as Hashimoto thyroiditis and diabetes mellitus type 1 in children (often without such cases among members of the family).

In adults, the pathology may start with premature cardiovascular diseases, organic neurological or mental diseases (localized in the left hemisphere in right-handlers), eye diseases, and many others. In some years, we may notice that cancer will be premature compared with the population from not

contaminated regions. The increase will probably not be statistically significant before 15 years from now, except for thyroid papillary cancer in small children. This tumor is so rare (one for one million), that ten cases could suffice for statistics.

## Conclusion

The justification for all these medical contributions, is the urgent necessity not to cultivate ignorance, but to stop lying. The population and the authorities have to become informed: it is urgent to develop antimutagene preparations to make an end to the transmission of deleterious hereditary factors, especially the genomic instability induced by radiation. Research for such tools have already started for clastogenic factors found also in victims of the A bomb on Hiroshima, and for the perigenetic alterations studied in Chernobyl.

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