LONG-TERM HEALTH EFFECTS

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If the experience of the survivors of the Japan atomic bombing and of other exposed populations is applicable, the major expected radiological impact of the Chernobyl accident will be deaths from cancer. The total lifetime numbers of excess cancer deaths will be greatest among the "liquidators" (emergency and recovery workers employed in 1986-87) and among the residents of "contaminated" territories. Any estimate of this excess is very unclear because of uncertainties in individual doses and in the exact magnitude of effects of low-dose protracted radiation exposure. Currently, however, our best estimates are: some 2000 extra cancer deaths lifetime among almost 200,000 liquidators from 1986 and 1987; and 4600 deaths among some 6.8 million residents of contaminated territories. Increases of this magnitude would be extremely difficult to detect epidemiologically against an expected background number of 41,500 and 800,000 cancer deaths, respectively, among the two groups.

On the basis of the data from other populations exposed to radiation, the major radiological impact expected to date (i.e. within the first ten years after the accident) is leukaemia. The increase is mainly expected among liquidators; indeed, if the experience of the atomic bomb survivors is applicable, the increase in this population should be detectable epidemiologically. Increases in leukaemia among liquidators have been reported, but they are not consistent. They are, moreover, difficult to interpret: the cases have not all been verified yet and the increases may reflect the effect of increased surveillance of the liquidators and under-registration of cases in the population in countries where systematic centralized cancer registration was limited at the time of the Chernobyl accident. No consistent increase has been reported to date. However, the present reports concern only a two-year period and the ability to detect such an increase is much reduced.

Increases in thyroid cancer among those exposed as children were observed in the more heavily contaminated regions of Belarus, Ukraine, and Russia, at rates much higher than predicted from previous studies. These increases may reflect either particular sensitivity of the population, due to host or environmental factors; or under-estimation of doses to the thyroid; or a higher carcinogenic potential of very short-lived iodine isotopes. Increases in thyroid cancer are now also reported among liquidators and the general population; for reasons mentioned above, these must, however, be verified before attributing them to the Chernobyl accident.

There is a tendency to attribute fluctuations and/or increases in cancer rates over time to the Chernobyl accident. It should, however, be noted that increases in the incidence of several neoplasms have been observed in some countries in the last decades, prior to the accident. A general increase in mortality has been reported in recent years in many regions of the former USSR which does not appear to be related to radiation levels. This must be taken into account when interpreting the results of studies.

Increases in the frequency of a number of non-specific detrimental health effects other than cancer among exposed populations, particularly among liquidators, have been reported. It is difficult to interpret these findings because exposed populations undergo a much more intensive and active health follow-up than the general population.

Based on results of animal experiments, it is possible that in addition to cancers, a small increase in hereditary disorders may occur following radiation exposure. On the basis of these data, the predicted occurrence of genetic effects induced by radiation from the accident would be very low, ranging from 0 to 0.03% of all live births and from less than 0.1% to 0.4% of all genetic disorders among the live births to the exposed population.

When considering predictions of the likely health effects of radiation from the Chernobyl accident, it is important to recognize that the current estimates of doses to exposed populations are uncertain; in particular, doses received early after the accident are not well known. The

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exposures received by populations due to the Chernobyl accident are, moreover, different (in type and pattern) from those of the survivors of the atomic bombing of Japan. Predictions derived from studies of those populations are therefore uncertain. Although an increase in thyroid cancer in children as a result of the Chernobyl accident was envisaged, the extent of the increase was not foreseen. Only ten years have passed since the accident, and on the basis of epidemiological studies of other populations, any increases in the incidence of cancers other than leukaemia are usually not visible until at least ten years after exposure. Therefore it is essential that monitoring the health of the population be continued to assess the public health impact of the accident, even if an increase in cancers caused by radiation from Chernobyl (except leukaemia among liquidators and thyroid cancer) may be difficult to detect.

Epidemiological studies of selected populations and diseases are also needed in order to study observed or predicted effects; careful studies may in particular provide important information on the effect of exposure rate and exposure type in the low to medium dose range and on factors which may modify radiation effects. As such, they may have important consequences for the radiation protection of patients and of the general population in the event of any future accidental exposure. Both cohort and case control studies are generally much more powerful than descriptive studies for investigating dose relationships. To be informative, however, studies of the consequences of the Chernobyl accident must fulfill several important criteria: they must cover very large numbers of exposed subjects; the follow-up must be complete and non-selective; and precise and accurate individual dose estimates (or markers of exposure) must be available. In particular, the feasibility and the quality of epidemiological studies largely depend on the existence and the quality of basic population-based registers, and on the feasibility of linking information on a single individual from different data sources.

In conclusion, ten years after the Chernobyl accident, there is, apart from the dramatic increase in thyroid cancer in those exposed as children, 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. No major increase in all cancer incidence or mortality has been observed that could be attributed to the accident. In particular, no major increase has been detected in rates of leukaemia — even among liquidators — one of the major concerns after radiation exposure. This is generally consistent with predictions based on studies of other radiation-exposed populations, in particular the survivors of the atomic bombings in Japan. ❐

Press briefing at the International Chernobyl Conference, where the accident's health effects commanded close attention.
(Credit: Pavlicek/IAEA)