THE REPERCUSSIONS ON PUBLIC HEALTH OF THE CHERNOBYL ACCIDENT

Following the Chernobyl nuclear accident in 1986 the Regional Director reported to the thirty-sixth and thirty-seventh sessions of the Regional Committee on progress achieved in activities relating to the public health aspects of nuclear accidents. The Committee endorsed the steps taken and authorized continued activities in the form of a special project aimed at harmonizing the public health response to such events.

In 1991 the Regional Office for Europe responded to reports from Belarus of an increase in childhood thyroid cancer by sending an expert mission to Minsk. The experts confirmed the reports and as a result the International Thyroid Project was set up, now managed by the European Centre for Environment and Health, Rome Division, in partnership with the International Agency for Research on Cancer (IARC) and under the umbrella of the International Programme on the Health Effects of the Chernobyl Accident (IPHECA).

The 1994 Helsinki Declaration identifies death and injury from nuclear accidents as a major challenge of environment and health and this concern is reflected in the Environmental Health Action Plan for Europe.

Accidents in nuclear facilities pose particular public health problems, in terms not only of morbidity from the direct physiopathological effects of radiation exposure but also of the stress caused by fear and anxiety engendered by the public’s perception of these risks. Steps could be taken to reduce considerably this latter health detriment where it exists today, and also to protect public health in the event of a future accident. It is essential that the lessons of Chernobyl should be applied in contingency planning at international, national and local levels, to mitigate the direct and indirect public health effects of any future nuclear emergency. WHO has a key role to play in these necessary initiatives.

This paper is supported by a more detailed information document (EUR/RC45/Inf.Doc./4).
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INTRODUCTION

1. Prior to the Chernobyl accident in 1986 few countries had given detailed consideration to the consequences of releases of radioactive material in other countries, except where facilities were close to international frontiers. The International Atomic Energy Agency (IAEA) had published very general guidelines on integrated planning and information exchange in the case of transboundary release of radioactive material, as well as guidelines for mutual assistance arrangements in connection with a radiation emergency, and the International Commission on Radiological Protection (ICRP) had considered planning principles for protection of the public. However, in the situation resulting from the Chernobyl accident the intervention levels for countermeasures and the levels of radioactivity in foodstuffs considered acceptable varied from country to country within the Region, causing much concern among the public and leading to distrust of the authorities.

2. Ionizing radiation is both cytotoxic and a weak mutagen, and is thus capable of damaging health in a number of ways. The qualitative and quantitative relationships between exposure and effect are known with reasonable confidence for acute whole body exposure to penetrating radiation from studies of survivors of the atomic bombing in Japan. However, confidence is lacking in the interpretation of these relationships to (i) partial body exposures, (ii) prolonged low dose rate exposures and (iii) exposures which are grossly non-uniform. For the most part exposure from radioactive fallout falls into these three categories and thus there is a lack of consensus in the scientific community about the health risks associated with such exposure.

3. The perception of exposure to radiation has long engendered fear in the population, perhaps due to the association of civil nuclear programmes with the military applications of nuclear technology, which have been veiled in secrecy, and with nuclear war itself. The Chernobyl accident demonstrated very clearly that such fear and concern will have definite effects on the health of a population which perceives itself to be exposed. This so-called psychosocial effect, to which currently more than 10 million people in the vicinity of Chernobyl are subject, constitutes the most important health consequence of the accident to date in terms of the size of the affected population.

4. Because of a lack of consensus on the health effects of exposure to environmental radiation, in both qualitative and quantitative terms, the public’s perception of the Chernobyl accident as a threat to health has been raised to levels that are, in some cases, quite unrealistic, thus increasing the stress and associated health effects. This applies to both the identity of the health effects attributed to exposure and the extent to which established effects are thought to have been increased by exposure. There is, therefore, a need for a better understanding of the long-term health risks of environmental exposure and for improved communication with the public, which will instil greater confidence in official advice in the event of future nuclear emergencies.
THE CHernobyl ACCIDENT

5. After the Chernobyl accident about 115 000 residents were moved from the 30-km radius exclusion zone surrounding the reactor. Extensive areas of the former Soviet Union and beyond its frontiers were affected by radioactive fallout. Some 650 000 people involved in the clean-up of the plant site and the 30-km zone were also exposed.

6. At the present time, nine years later, many of the expected potential health effects of exposure to radiation have not yet become apparent because of the long latency for some radiation-induced cancers. The full impact of the accident will become evident only after several decades. So far the health consequences are as follows:
   • acute radiation sickness and burns to the skin from beta radioactivity in some 200 people, causing 28 deaths from acute radiation syndrome;
   • childhood thyroid cancer in children living in Belarus, the northern districts of Ukraine and areas on the eastern border of the Russian Federation with Belarus and Ukraine with, so far, nearly 500 cases of childhood thyroid cancer detected in a population of about 3 million children particularly at risk;
   • psychosocial effects from stress-related conditions, ranging from lifestyle changes to near complete social disintegration of communities, and involving populations up to several hundred kilometres from the accident site;
   • some excess disease, such as leukaemia, that might have been expected but has not been revealed so far.

7. On the basis of past experience of exposure to radiation, further effects may be anticipated. The increased incidence of thyroid cancer can be expected to continue for several decades. The tissue most sensitive to radiation exposure, in addition to the thyroid and bone marrow, is the breast of young women. Exposed populations within 100 km are likely to be particularly at risk. The isotopes of iodine could contribute to breast dose at certain stages of development or during and after pregnancy.

8. The effects of airborne radioactive particles on the induction of skin and lung cancers is also a matter for concern. Such particles were observed far afield and animal experiments have shown them to be capable of inducing lung tumours.

9. Due to the size of the exposed population, hitherto unrecognized effects of radiation resulting from the incorporation of fission products into the body may well become evident in due course.
THE LESSONS OF CHERNOBYL

10. There have been many public health lessons from Chernobyl but perhaps the most important is recognition of the importance of psychosocial effects. From the outset the psychosocial impact of the Chernobyl accident was apparent. In 1990 WHO convened a working group meeting in Kiev on the psychological effects of nuclear accidents. The group identified the many aspects of this problem and some of the factors giving rise to it.

11. The initial reaction to the accident highlights the need for a regionwide system of contingency planning and advice in the event of future nuclear emergencies. Much of the public concern and the detriment to health associated with it can be attributed to the fact that, at the time of the accident, there appeared to be widespread confusion between the statements and actions of different authorities. WHO/EURO, together with IAEA and other international bodies, has been engaged in harmonizing contingency planning in close collaboration with Member States.

THE POTENTIAL FOR FUTURE ACCIDENTS

12. Shortly after the Chernobyl accident an estimate of the probability of a future serious accident in a civil nuclear reactor was made on the basis of past experience, i.e. the Chernobyl and Three Mile Island accidents. This suggested a 95% probability over the twenty years commencing in 1986. That figure is much higher than estimates based on reactor component and safety systems failure. However, since the latter does not take account of human failure, which was a significant factor in the causation of the Chernobyl accident, the two estimates may not be as incompatible as they seem.

13. The safety of reactors is thus not only a matter of engineering and design. In a recent WHO/EURO report1 a “culture of safety” was identified as being at least as important as engineering aspects. For countries in transition, economic circumstances may militate against operating in such a culture of safety since maintenance, precautionary shutdown and adequate training all consume scarce resources.

14. The dispersion patterns of deposited radionuclides after the Chernobyl accident have made it clear that, among other factors, weather conditions will have a strong influence in determining the degree of population exposure for any given release. While different weather conditions may have reduced the impact of Chernobyl on exposed populations, they may equally have increased it several-fold. Given the chaotic nature of the weather it is clear that the health impact of future accidents will remain largely unpredictable.

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1 Concern for Europe’s tomorrow: summary. Copenhagen, WHO Regional Office for Europe, 1994 (WHO Regional Publictions, European Series, No. 53).
ROLE OF WHO

15. The occurrence of the Chernobyl accident became known to the rest of Europe on the second day after the accident, when increased levels of radioactivity were detected in Finland and Sweden. Although there was no regionwide contingency plan for such an event, WHO/EURO was quick to respond. On the days following the accident several requests for information and advice from Member States were received. An expert team was recruited and as much information as possible was assembled on radiation levels throughout the Region.

16. On 6 May 1986 (some 10 days after the accident) a meeting of experts was convened in Copenhagen to consider the course of events and their likely public health impact. By the end of that day a summary report of the meeting had been widely disseminated. The consistency of countermeasures enacted in different countries was an important issue and WHO's advice in this respect highly regarded.

17. At the end of June 1986 a meeting to make a preliminary assessment of the public health impact of the accident was convened and provided the basis for a long-term strategy, particularly in relation to food supplies.

18. Since the immediate aftermath of the accident, WHO/EURO has undertaken a number of initiatives in the form of meetings and reports, to a large extent with the benefit of generous funding from Switzerland. Much of this activity has been devoted to the development of guidelines for use in a regionwide contingency plan. Following a 1991 meeting in Solothurn, Switzerland, it was agreed that a manual on public health action in radiation emergencies should be prepared. Experience gained in Belarus on the increased incidence of childhood thyroid cancer after the accident led to proposals by a working group (Rome, May 1995) to revise the advice given on the application of stable iodine prophylaxis. As recommended by the same working group, WHO's guidelines on iodine prophylaxis will be amended. The subject of informing the public in the event of radiation emergencies was also discussed by a working group (Rome, April 1994).

19. While considerable progress towards the implementation of an emergency response system for radiation accidents affecting the Region has been made by WHO, in any future nuclear emergency there will be an urgent need, from the moment of the accident onwards, for extensive information on the type of release, the weather in the vicinity, and the forecasts for the following hours and days, so that an expert team can provide advice on protecting populations from exposure as far as is practicable. In some circumstances this may be available through the IAEA Nuclear Emergency Response System (see below) but it is felt that there is a need for more direct access to such information. This could best be achieved by close collaboration with existing national emergency facilities. There is also a need to consolidate this aspect of WHO's activities, which rely on voluntary funding.
20. Also with Swiss funding, WHO/EURO investigated the first reports of an increase in thyroid cancer in Belarus. The resulting letters to the international science journal *Nature* were instrumental in alerting the scientific community to the now widely recognized sensitivity of children to radiation from the isotopes of iodine. From this early initiative the International Thyroid Project (ITP) has been developed to provide Belarus with advice, training and support in the diagnosis and treatment of childhood thyroid cancer and with the capability to monitor and assess its public health impact. Funding is currently being sought for activities within this important project which would be of benefit to all three affected countries.

21. In May 1991 the World Health Assembly approved the International Programme on the Health Effects of the Chernobyl Accident (IPHECA), mainly funded by Japan. Under this 3-year programme US $15 million have been disbursed on medical supplies for the affected countries. In addition, four pilot projects were initiated, dealing with the thyroid, blood-forming organs, exposure *in utero* and epidemiology. The ITP builds on the achievements of the IPHECA pilot project on the thyroid and is managed jointly by WHO/EURO and IARC within the IPHECA framework. A report on IPHECA is in preparation and an international conference on environmental radiation effects is being organized for November 1995. The principal results of this conference will be presented at an international meeting to be held in Vienna in April 1996, sponsored jointly by IAEA, the European Union (EU) and WHO.

**THE INTERNATIONAL RESPONSE**

22. Under the 1986 conventions on early notification and assistance in the case of nuclear accidents, signatory states are required to notify IAEA of any accident within their territory and, if radioactivity crosses national boundaries, IAEA undertakes to inform other states that they may be affected. In this context IAEA has developed an Emergency Response System which will operate while the risk of fallout persists. In the event of an emergency with public health implications IAEA would look to WHO for advice.

23. Considerable humanitarian assistance has been provided to the affected areas by international agencies and through bilateral agreements and private charitable initiatives. This has included training, the provision of medical equipment, assistance with treatment of children suffering from thyroid cancer, the rehabilitation of children from affected areas in other countries, etc. Linked to this aid a number of research initiatives have been proposed and some are in progress.

24. In these respects the lack of effective coordination between the different aid programmes and the various research initiatives threatens to be counterproductive in terms both of the achievement of aims and objectives and the effectiveness of assistance provided.
CONCLUSIONS

25. The Chernobyl accident represents a serious public health problem in two respects, namely psychosocial and physiopathological, with health effects currently being manifest in both ways. While the full physiopathological impact will not be clear for several decades, the accident has already illustrated the magnitude of the hazard of exposure of the young to the isotopes of iodine and the extent to which such effects may be observed.

26. On the other hand, as a result of the Chernobyl accident, the full extent of the psychosocial impact of nuclear accidents has become clear. Lack of trust by the public in the authorities and uncertainties and a lack of consensus among the scientific community in predicting health consequences in a quantitative manner are important factors in sustaining the psychosocial response. This underlines the importance of an integrated approach to the public health aspects of exposure to environmental radiation, taking into consideration physiopathological as well as psychosocial effects.

27. Information in this respect is offered both by the authorities dealing with a radiation emergency and by experts predicting the effects of exposure to radiation. In general, authorities and experts with a vested, and especially economic, interest in nuclear power do not engender public trust, thus creating a need for an independent, authoritative and international body to protect the public health interest.

28. Much of the health detriment due to psychosocial effects (potentially involving more than 10 million inhabitants of the Chernobyl area and substantial populations elsewhere in the Region) would be mitigated by:

- objective clarification of the extent of exposure to populations which perceive themselves to be exposed;
- the acquisition of directly determined information on the health effects of environmental exposure to radiation by facilitating and harmonizing research on existing situations in the Region;
- the provision of advice on the public health aspects of radiation exposure by a clearly identified and trusted body, independent of national authorities and vested interests;
- the introduction at all levels of well organized contingency planning in relation to the public health consequences of any future nuclear emergency; and
- education of key sectors of the public health community on the effects of radiation.

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2 This lack of trust is, for instance, apparent in the initial scepticism over the now established increases in childhood thyroid cancer.
29. In the light of experience, the probability of further accidents in civil nuclear power facilities cannot be ignored. In addition, although these are generally smaller, there are at least as many military facilities, many of them mobile – for instance on ships. This highlights the importance of WHO/EURO maintaining regionwide emergency preparedness for radiation accidents, well coordinated with IAEA and EU initiatives, and able to respond in a flexible way to the different circumstances that an accident may present.

30. The Chernobyl accident has met with a substantial response in terms of humanitarian aid and collaborative research from outside the former Soviet Union. However, in spite of efforts at coordination, the work continues to be fragmented.

31. WHO/EURO’s contribution has been notable in helping to clarify the health consequences of the accident and in planning a response system to protect public health in the event of future accidents. However, much remains to be done both in mitigating the health effects among the affected populations and in learning for the future.

**RECOMMENDATIONS**

32. The WHO/EURO programme on radiation should continue and be strengthened to enable it to fulfil the following tasks:

- extend the activities of the International Thyroid Project to Ukraine and the Russian Federation at the request of these states;
- investigate new reports of health effects following the Chernobyl accident;
- extend the activities to deal with public health consequences in other geographical areas affected by radiation contamination and meet requests for objective advice on the extent of exposure and mitigation of effects, both physiopathological and psychosocial;
- continue its activities concerned with other aspects of radiation and public health;
- initiate a programme for education of key sectors of the community on the health effects of radiation.

33. WHO/EURO should continue its activities, in close collaboration with other interested international bodies, in ensuring a harmonized regionwide contingency plan for a radiation emergency.

34. The emergency response system for radiation accidents at present being developed within the WHO/EURO programme on radiation should be consolidated and strengthened.
35. WHO/EURO should extend its activities to act as a facilitator of international collaborative research on the health effects of environmental exposure to radiation, using experience gained in contaminated areas within the Region.

36. The international community should endeavour to further improve coordination of the provision of humanitarian aid and collaborative research activities with the affected countries.
Annex 1

A SELECTION OF WHO/EURO PRODUCTS RELATING TO THE PUBLIC HEALTH ASPECTS OF NUCLEAR ACCIDENTS AND RADIATION EMERGENCIES

Reports of working group meetings:
3. Psychological effects of nuclear accidents: summary report on a Working Group. Copenhagen, WHO Regional Office for Europe (document EUR/ICP/CEH 093(S)).

Guidelines:
1. Guidelines for iodine prophylaxis following nuclear accidents. Copenhagen, WHO Regional Office for Europe, 1989 (Environmental Health Series, No. 35).

Scientific publications:

Other publications: