International Conference

Fifteen Years after the Chornobyl Accident. Lessons Learned

EXECUTIVE SUMMARY

Kyiv, Ukraine, April 18-20, 2001

ORGANIZERS OF THE CONFERENCE

Ukraine
Ministry of Ukraine of Emergencies and Affairs of Population Protection from the Consequences of Chernobyl Catastrophe *in co-operation with*:

Russian Federation,
Ministry in Affairs of Civil Protection, Emergencies and Liquidation of Disaster Consequences

Republic Belarus,
Committee on problems of Chornobyl NPP catastrophe consequences,

European Commission,

International Atomic Energy Agency,

UN Office for the Coordination of Humanitarian Affairs,

Council of Europe Open Partial Agreement on the Prevention of, Protection against and Organisation of Relief in Major Natural and Technological Disasters,

National Academy of Science of Ukraine,

International Union of Radioecologists,

European Centre of Technogenic Safety,

Institute of Protection and Nuclear Safety, France,

Nuclear Safety Institute, Germany.

Introduction

This Executive Summary of the results of the International Conference "Fifteen years after the Chernobyl accident. Lessons learned", held in Kiev on April 18-20, 2001, is based on the material provided in the national and invited reports, the session conclusions, as well as the conclusions of other international conferences.

The Conference recommends that this Executive Summary of the Conference be used for future decision-making.

The main aim of the Conference was:

- for the scientific community in the most affected countries to develop a common vision with the international scientific community with regard to the consequences of the Chernobyl disaster (in ecological, medical, social and other areas 15 years after the event);

- to draw conclusions and provide recommendations to allow authorities and decision-makers at both the national and international level to take further steps to mitigate the effects of the disaster;

- to elaborate a common international understanding of the current situation resulting from the accident and of the future initiatives which will be necessary to counter its effects.

Now that 15 years have passed since the Chernobyl disaster, it is possible to weigh up more fully its causes and consequences, as well as the effectiveness of the countermeasures implemented.

During those years many different views have been expressed on the radionuclide contamination of the areas, foodstuffs, water bodies and forests, on the state of the destroyed reactor, the number of casualties, and the consequences for public health. It is quite clear, however, that this disaster significantly changed the lives of millions of people - especially in Belarus, Russia and Ukraine - living in the most heavily contaminated areas.

Apart from the extent to which people's health was damaged by the "Chernobyl" radionuclides, events related to the accident, such as relocation, restrictions on agricultural and industrial production, other countermeasures implemented and information on conflicting assessments of the possible consequences, radically changed people's lives.

Not having any specialized knowledge of radiology, people could not assess for themselves the objectiveness of the information received via the press, radio and television. As a result, subjective perceptions of the possible accident consequences were many times worse than the realities of the situation. All this, together with the worsening economic situation and the disintegration of the USSR, turned the accident into a real catastrophe for

millions of people, who have been categorized as "victims of the consequences of the Chernobyl nuclear power plant (ChNPP) accident".

Based on a common understanding of the causes and consequences of the accident, as well as the efficiency of the response, the Conference has determined the main lessons learned from the Chernobyl catastrophe and has drawn the following conclusions and recommendations.

Lessons learned from Chernobyl

1. The scale of the material losses and the financial cost of mitigating the consequences of the Chernobyl accident provide compelling evidence of the extremely high price of errors and shortcomings when ensuring the safety of nuclear power plants and of the need for strict compliance with international safety requirements during their design, construction and operation.

2. The accident has convincingly demonstrated, that the cost of ensuring the safety of nuclear facilities is significantly lower than that of dealing with accident consequences. Large-scale man-made accidents cause great social and economic damage to countries located in their area of influence. Hundreds of billions of US dollars' worth of direct and indirect damages have been reported by Belarus, Russia and Ukraine as a result of the Chernobyl nuclear power plant accident over the past 15 years.

3. The Chernobyl accident has led to a part of the population developing an inadequate perception of radiation risk, which has caused psychological problems and, as a consequence, a deterioration in public health and quality of life.

4. The accident has shown the importance of strict compliance with the basic and technical safety principles for nuclear power plants, of continuous safety analysis of operating nuclear power plants and of their early upgrading in order to eliminate deviations, of active study and the introduction of leading world experience, and of taking thorough account of the human factor.

5. The accident has demonstrated the need to establish and support a high-level national emergency response system in case of man-made accidents.

6. The accident has demonstrated the danger of not bringing nuclear power under public control and has shown the need for open and objective dialogue with the public on all aspects of the safe use of nuclear energy.

7. The creation of the Chernobyl Exclusion Zone (ChEZ) was a justified measure not only in view of the need to evacuate the population from the most contaminated area, but also having regard to the follow-up tasks of mitigating the accident's consequences. The Exclusion Zone is the most highly contaminated area and the largest source of radiation hazard to the surrounding populated areas. Thanks, moreover, to its natural and man-made barriers it has - and in future will continue to have - the important protective function of preventing the migration of radionuclides beyond its boundaries. Continuing activities to study, support and strengthen the barrier function of the ChEZ remains the most important focus of efforts to minimize the accident's consequences.

8. The radioecological monitoring system established in the Exclusion Zone, including the "Shelter", has enabled monitoring of the existing situation; however, it does not produce

entirely reliable predictions of the radioecological and ecological situation, either for the Zone as a whole, or parts thereof.

9. The experience obtained over the past 15 years shows that a complete halt in economic activity in the Exclusion Zone is impossible because it does not lead to spontaneous recovery of the contaminated ecosystems to their original state. At the same time, there is an additional risk of radionuclide release outside the Zone. In many cases, spontaneous evolution leads to secondary negative radioecological and ecological consequences (forest fires, floods, outbreaks of plant and animal epidemics, and so on), which require human intervention in view of the hazard to populated areas.

10. Scientific co-operation thanks to the efforts of many countries (Belarus, Russia, Ukraine, countries of the European Union, USA, Japan and others) and international organizations (UN, WHO, IAEA) has produced important scientific results in nuclear and radiation safety, radioecology and radiation medicine, which are of significant practical importance. However, insufficient funding of national scientific research programmes and their lack of co-ordination do not facilitate the creation of a sound and comprehensive scientific research strategy. At both the national (Belarus, Russia, Ukraine) and international level, there is a need to develop and improve scientific research programmes which take into account the long-term tasks.

11. Managing the radioactive waste from the Chernobyl accident is becoming a more pressing and topical problem as time goes on. Despite the established national programmes and international projects on radioactive waste management, there is still no realistically balanced and sound (taking into account the “Shelter” aspect and decommissioning of the Chernobyl nuclear power plant) unified concept for radioactive waste management which includes all stages from collection and processing to final disposal.

12. Dealing with the consequences of the accident in the agro-industrial sector has become an important part of ensuring public radiation safety. The system of countermeasures developed has resulted in a decrease in exposure to the population and precluded the production of contaminated products.

13. Implementation of the agricultural countermeasures has revealed critical areas where even a relatively small amount of contamination of the soil by long-lived radionuclides leads to considerable contamination of plant and animal products due to the high rate of soil-to-plant radionuclide transfer. Failure to take this phenomenon sufficiently into account reduces the effectiveness of the countermeasures in agriculture and leads to irrational wastage of material resources.

14. The Chernobyl accident resulted in unprecedented exposure of the Belarussian, Russian and Ukrainian population. In view of its uniqueness in terms of spatial, temporal, professional and age specific factors, as well as the combination of external and internal exposure, it has no analogy in the entire history of man-made accidents.

15. In the fifteen-year post-accident period, most of the local population living in the contaminated areas have already received 60-80% of their anticipated life-time dose. Over the next 10-20 years, the main dose-related radionuclide in these areas will be ^{137}Cs, accounting for up to 90% of the total additional dose. The internal dose, caused mainly by the consumption of locally-produced contaminated foodstuffs, accounts on average for 40-60% of the total “Chernobyl” dose, and in critical areas - up to 95%. In these critical areas countermeasures should focus on the consumption of "clean" foodstuffs.

16. At the time of the accident the medical services were not equipped to deal with or minimize the medical consequences of a large-scale man-made accident. The stable iodine prophylaxis was not administered in time or on a sufficient scale and protective measures such as sheltering and the replacement of contaminated with “clean” milk were barely used. The countermeasures to reduce psychological stress in the population were ineffective. In the initial phase of the accident and for the first five years thereafter, there was a shortage of medical personnel (doctors, nurses, laboratory workers) in the regional hospitals. On the whole, only the leading hospitals were able to provide high-quality, timely and proper treatment.

17. The early clinical effects in the first months after the accident were attributable to radiation (ionizing radiation of all types) and non-radiation (high concentration of chemical substances, changes in living conditions, inadequate psychological perception of the radiological hazards) factors.

18. However much money and effort is expended on improving nuclear safety, the probability of a nuclear accident will never be zero and, since people may suffer as a result, we should be prepared to minimize losses through timely response. Analysis of the response experience with respect to the Chernobyl accident provides a unique opportunity for improving the emergency response system, which should include well-defined procedures for action, trained personnel, the necessary instruments and equipment, criteria and mechanisms for decision-making developed in advance, and a system for training emergency workers. This experience should be integrated into international recommendations and methods for assessing, monitoring and responding to nuclear accidents.

19. The lack of objective and timely information to state authorities and the population about the accident at the Chernobyl nuclear power plant led to an inadequate response to its potential negative consequences on people’s living conditions and health, and also created the preconditions for socio-psychological stress.

20. The adoption of legislative acts and legal documents has allowed a significant easing of the socio–psychological situation among clean-up workers and the affected population.

Conclusions and recommendations for future action

1. The localization of the consequences of the Chernobyl accident and the speedy construction of the "Shelter" were positive outcomes of the concentrated efforts of government bodies, financial and material resources, and scientific, technical and economic potential, enabling considerable mitigation of the negative consequences of the accident.

2. Ukraine has taken the decision to decommission the Chernobyl nuclear power plant, an important step towards improving nuclear and radiation safety. Decommissioning of the Chernobyl nuclear power plant should be integrated into the overall Exclusion Zone strategy and other projects focusing on radioactive waste management and improving the environmental situation. Shutting down the Chernobyl nuclear power plant has created a number of social problems for workers and the inhabitants of Slavutich. Resolving them requires appropriate measures and urgent action on the part of the Government and the private sector, input from businesses and financial bodies, and international support.

3. Work on the "Shelter" will require comprehensive scientific support throughout its existence. It is necessary to continue studying the amount of nuclear fuel contained in the “Shelter”, as well as the physical and chemical processes which are changing the properties of the radioactive masses, and the radionuclide migration.

4. It is extremely important to adopt an optimal strategy for ensuring the safety of the “Shelter” and transforming it into an ecologically safe system. At the same time, ways of organizing future activities to manage the fuel-containing masses should be sought. Selecting technologies for the latter and the time-scale for implementing them should be co-ordinated with the plans and options for setting up a national infrastructure for managing high-level radioactive waste, including final disposal. Urgent resolution of the pressing problems of water migration and stabilization of the unstable structures should improve the safety of the “Shelter”.

5. Assessment of the Chernobyl Exclusion Zone’s barrier function, its reliability, the natural recovery processes and validation of possible additional protection measures and their implementation should be an important combined task of ongoing and future national and international scientific research and applied programmes.

6. Rehabilitation of the contaminated land in the Chernobyl Exclusion Zone and the enforced relocation zone should be based on maximum allowance for the natural recovery processes with a limited, focused human intervention. The return of the land to economic use should envisage the establishment of an ecologically safe and economically effective rehabilitation system.

7. It is necessary to improve the radioecological monitoring system of the Chernobyl Exclusion Zone and other contaminated areas by strengthening its predictive function, which is essential in order to take effective administrative decisions.

8. The complexity, importance and diversity of the long-standing problems that have arisen as a result of the accident make it necessary to support a high level of scientific research both now and in the future. It would make sense to improve the national and international co-ordination of such research.

9. It is necessary to co-ordinate, at the national and international level, efforts to implement radioactive waste management programmes and projects to transform the "Shelter" into an ecologically safe system, as well as Chernobyl nuclear power plant decommissioning projects.

10. In planning measures aimed at rehabilitating contaminated agricultural land, it is necessary above all to identify the critical areas where the chief radiation hazard factor for the population of Belarus, Russia and Ukraine is the intake of ^{137}Cs with contaminated foodstuffs, especially milk. This problem should continue to have a high priority and be addressed by strengthening active countermeasures in fodder production and animal husbandry.

11. Investigations of the effects of radiation on biota in the Chernobyl Exclusion Zone have shown an increase in the frequency of radiation-induced chromosomal aberrations. Also, various genetic effects of chronic exposure have been reported. It would be useful to stimulate research into the radiological effects of small doses on biota and ecosystems, ensuring thorough dose monitoring.

12. The impact of the accident on the biota and the population should be examined, taking into account the following aspects:

- Chernobyl radioactive contamination occurred in areas previously subjected to various types of non-radioactive contamination and also characterized in some places by high natural radioactivity, mainly due to radioactive radon. Account should therefore be taken of their possible complex impact on organisms;

- the migration rate of radionuclides and their uptake by organisms is substantially affected by topographical and geochemical conditions, which should be taken into account in the specific evaluations.

13. Deterministic effects caused by radiation exposure and intensified by other accident factors (burns) have been observed. The early radiation effects led to the development of acute radiation syndrome (ARS) in 134 victims, whose radiation dose varied from 1 to 12 Gy. Of these, 28 died within the first three months as a result of combined radiation and non-radiation injuries, and a further 14 in subsequent years. The 92 ARS convalescents constitute a priority medical observation group and, in order to minimize the delayed stochastic effects, should be given all the necessary medication, diagnostic and medical services for the rest of their lives.

14. Regarding the stochastic effects in humans caused by the ionizing radiation which is characteristic for the Chernobyl accident, the following conclusions and recommendations have been made:

- the dramatic increase in radiation-induced thyroid cancers in children and adolescents in Belarus, Russia and Ukraine, which has been observed since 1991, continues to this day. Further thyroid cancer cases are expected in the coming decade in persons who were exposed as children and also in the clean-up workers of the accident in 1986. To minimize the effects of thyroid cancer among the exposed population and the clean-up workers, measures aimed at timely detection and treatment of these cases should be implemented;

- the possible increase noted in the incidence of leukaemia above the spontaneous level in the Russian clean-up workers and the fact that there is no increase in the incidence of leukaemia among the adult and child population living in the contaminated areas of the three States should be the subject of further standardized epidemiological studies. It is especially important that all diagnoses of leukaemia be confirmed by an international team of haematologists;

- some data from Ukrainian scientists have indicated a possible increase in the other solid cancers (breast cancer, lung cancer, urologic cancers, etc.) among the inhabitants of the contaminated areas and the clean-up workers, and this should be the subject of further epidemiological study;

- to date, studies on possible genetic defects, hereditary diseases and congenital anomalies, due to radiation effects of the Chernobyl accident have not been developed sufficiently. It is therefore essential to embark on research in this field, paying special attention to the children of clean-up workers and to children from the most highly contaminated regions who were exposed *in utero*.

15. Health effects of the consequences of the accident have been observed in clean-up workers and the population of contaminated areas for which the radiation dose effect relationship has not been established. Further studies are necessary to include other possible causes, such as, psychological and social consequences, ageing and the effect of screening, so as to identify their relevance to the following data:

- the progressive deterioration in the health of the 1986-1987 clean-up workers in the three countries;

- for a number of non-oncological diseases (diseases of the endocrine system, cardiovascular diseases, psychoneurotic disorders, etc.), the morbidity indexes among the clean-up workers, the population living in the contaminated areas and evacuees from the Exclusion Zone statistically significantly exceed the national averages for all citizens.

16. The mortality of the clean-up workers and the inhabitants of the contaminated areas does not exceed average mortality in the three countries. At the same time, it is necessary to continue research to assess the importance of the contribution of different factors in the mortality indexes.

17. A negative demographic trend has developed in the contaminated areas of Belarus, Russia and Ukraine. A variety of factors are resulting in a drop in the birth rate, a deterioration in women's reproductive health, an increase in complications during pregnancy and birth, and a deterioration in neonatal health. The public health services of the three countries should provide financial and social support to curb these negative trends.

18. The dynamics of change in the state of health of children affected by the Chernobyl accident in all three countries - Belarus, Russia and Ukraine - in the post-accident period is characterized by persistent negative tendencies: the morbidity rate is going up, the number of really healthy children is dropping, and disability is increasing.

19. The priorities for maintaining and improving children's health should be:

- ensuring the availability of qualified and specialized help;

- carrying out preventive, therapeutic and rehabilitation measures;

- integration and co-ordination of the efforts of Belarus, Russia and Ukraine, and international organizations to develop and implement high-performance methods for the diagnosis, treatment and rehabilitation of children affected as a result of the accident at the Chernobyl nuclear power plant.

20. In the next 10 years (until 2010) we can expect a continuing trend towards increase in morbidity for many types of disease and, possibly, malignant neoplasms, in view of the natural ageing of the affected cohorts. The cohorts given priority for follow-up should be persons who have had ARS, clean-up workers who received radiation doses of more than 250 mSv, evacuees from the 30-km zone, persons with a high irradiation dose to the thyroid gland, pregnant women and children living in contaminated areas and born to highly irradiated parents.

21. It is advisable that the governments of Belarus, Russia and Ukraine continue to improve the health care system and social protection of those suffering as a result of the Chernobyl accident, paying special attention to exposed individuals who qualify for continuing medical follow-up services.

22. As before, many people do not have a realistic understanding of the continuing radiological situation and risk. To a certain extent this is preventing rehabilitation of the contaminated areas. More emphasis should be given to the establishment of a reliable public information system about the radiological situation.

23. At the present time there is a need to review the strategy for compulsory relocation of people from the contaminated areas in terms of socio-psychological and radiological factors. The governments of the three countries should develop their policy regarding the contaminated areas with a view to creating the conditions for real economic regeneration and social rehabilitation.

24. In order to improve the health of the people, and the economic and social conditions in the radionuclide contaminated areas, it is necessary to:

- improve the national approach to restoration of the economic and social infrastructure in the contaminated areas and in places where there are large evacuee populations, and establish favourable conditions for attracting domestic and foreign investment;

- ensure improvement of the medical service, and social and psychological rehabilitation of the population evacuated from the Exclusion Zone and enforced resettlement zone;

- provide optimized systematic countermeasures aimed at reducing the internal and external doses to the population in all areas contaminated by "Chernobyl" fallout where countermeasures are justified;

- develop a social and psychological network aimed at overcoming de-stabilizing psychological factors in all groups suffering, above all, from the “Chernobyl accident victim” syndrome, which prevents those affected from taking an active part in social and economic activities;

- create a rapid and objective system for informing the public about the radiological situation in the region, the effectiveness of the countermeasures, the scientific and medical recommendations for protection against the effects of ionizing radiation and new ways of overcoming the negative consequences of the accident.

25. It is necessary to continue activities on evaluating the consequences of the Chernobyl accident in order to ensure an adequate policy with regard to the contaminated areas, to implement a series of measures for the economic, social and psychological rehabilitation of the population, and also to provide information to the population.

26. The Conference has demonstrated the crucial importance of international co-operation in order to resolve the Chernobyl problems.

27. The participants of the International Conference are grateful to the Government of Ukraine and the other organizers for preparing and conducting such an important meeting.

28. The Conference instructs the Program Committee to disseminate widely this Executive Summary. In addition, the Conference papers should be summarized and disseminated.