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# "Chernobyl" Lessons Learned for Post-Emergency Response

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## INTRODUCTION

The scale of the Chernobyl accident, non-total readiness in regulation and extraordinary unstable political situation in the country were important reasons for not optimal and even erroneous performance. Due to this performance the scale of off-site consequences at least on the Russia territory increased by order of magnitude. Nevertheless, some useful lessons can be learned from the experience for post-accident management. Analysis of data is made concerning the off-site consequences resulted from the accident impact and countermeasures adopted, science-methodical basis and regulation being developed and used in the course of the post-accident activity. This analysis is used to formulate some lessons and recommendations addressed to post-emergency management.

The national and international regulatory documents at the moment of the Chernobyl accident were neither complete nor perfect in some necessary aspects especially in respect to the countermeasures at the intermediate and long-term phases. They were mainly prepared for the first phase of a post-emergency response (PER). The same should be said about the decision support tools including the scientific basis (methods, guides, recommendations, computer data bases, codes etc. for measurement of radioactive contamination in nature media, dose, health risk and economic consequences assessment). New documents and decision support tools have been worked out in the course of the intervention activity.

The intermediate phase of PER (the last years of the 80s) coincided with the process of political and economic changes in the USSR. This process together with the regime of secrecy and then quick transition to total openness in the information on the Chernobyl items prevent from adequate and justified PER decisions. Non-consistent actions of the authorities, bewilderment of a part of the specialists, contradictory and disturbed information, activity of non-professional groups led to loss of confidence to the governmental bodies and increase of social tension on the suffered territories. Social-psychological factor turned into the very serious source of negative health effects (see the analysis of this PER phase in [1]).

Under pressure of these circumstances the main regulatory document - the Chernobyl Law - was adopted in 1991. In contradiction with recommendation of the specialists (Concept-91 [2]) and radiation protection principles the very controversial and erroneous items were introduced into the Law. They resulted in the broadening of the territories where radiation and social protection should be implemented and increasing of the population concerned by this protection. The number of the Russia administrative regions which territories in some their parts were recognized as suffered from the accident changed from 3 up to 17 and population respectively increased from 100 - 150 thousand up to 2.7 million people. The other results of these decisions were the following:

- expenses for PER grew highly with very ineffective use of the most part of them,
- additional compulsory mass relocations were decided,
- optimum levels of protection from a complex of countermeasures were impossible to achieve,
- the area of the social tension, effects of the social-psychological factor, negative changing of social and economic conditions respectively increased,
- consequences of the accident (due to the erroneous decisions) expanded over the territories which were not radioactively contaminated to significant levels from the accident,
- these decisions and the way of social compensation adopted on the suffered territories (personal annual payment) continue to make the transition to the rehabilitation policy difficult.

## 1. LESSONS and RECOMMENDATIONS

In 1991 a paradoxical phenomenon arose. Instead of changing to a recovery phase in PER as it was demanded by the real situation and recommendations of the specialists, the scale of intervention did remarkably increase. This phenomenon was a result of both current social-political processes in the USSR/CIS/Russia and lack of methodology for decision making at the late stages of the post-accident situation [3].

Nevertheless, some useful lessons can be learned from the experience for post-accident management. Analysis of data is made concerning the off-site consequences resulted from the accident impact and countermeasures adopted, science-methodical basis and regulation being developed and used in the course of the

post-accident activity. This analysis is used to formulate some lessons and recommendations addressed to post-emergency management. The most general and important among them are the following:

- A total and justified regulation is necessary for post-emergency management and should be one of the obligatory nuclear safety requirements. It will give solid base for assured actions to all participating bodies in the case of a possible future accident. New regulation introduced after an accident may create social distortion and distrust to ruling bodies. The regulation documents elaborated and adopted in 90-th are not still quite satisfactory and should be improved and extended beyond one-dimensional radiation protection approach to social and health protection;
- Post-accident management is not radiological problem only. Radiation and non-radiation risks should be considered. Radiological as well as social and health protection should been included in post-accident management with proper regulation;
- The social-psychological factor is very important. Even scientifically optimal countermeasures need social understanding and support;
- Transition from post-accident period to a normal life is complicated due to social-psychological difficulty to accept residual effects. A special regulation and strategy is needed for this transition period.

## 2. DEVELOPMENT OF THE REGULATIONS AND DECISION AIDING TOOLS AFTER 1991

In 1991 it was recognized that in Russia there are other territories suffered in the past from non-routine radioactive contamination in addition to those affected by the Chernobyl accident (Ural region, territories near nuclear weapon test sites, etc.). Respective programs of practical measures on radiation and social protection and rehabilitation were elaborated and adopted (the Ural program and the program "Semipalatinsk Nuclear Weapon Test Site/Altai" ("Altai" program)). These programs were also needed in proper regulation documents.

Since 1991 a set of general [4-10] and specified PER regulation documents as well as decision support tools began to be elaborated in the frame of national and international R&D programs [11,12].

The goals of these R&D are elaboration and justification of the Chernobyl and other PER program on the final (restoration) phase and all necessary recommendations, decision aiding tools, data, etc. for total readiness to PER in the case of a future radiation accident.

It was recognized that in these documents one should:

- consider as interacted all post-accident phases: early, long-term and a final restoration (rehabilitation) one's;
- develop in more detail not only radiation but also social (including health, economic, etc.) protection aspects.

Social protection should have its own system of decision making regarding dose levels expressed in residual doses. Radiation protection criteria for intervention are usually expressed in avertable doses.

## 3. NEEDS IN RISK ANALYSIS

Necessity to go beyond the simple radiation protection approach in the post-accident response decision making and to use risk assessment considering radiological as well as non-radiological factors is one of the lessons learned from the Chernobyl and other protection and restoration activity and research. The proper PER needs in rather detailed data from radiation risk assessment which take into account their dependence on time, countermeasures adopted, local health-demographic characteristics etc. [3,10].

Needs in non-radiation risk assessment data goes from the following:

- some countermeasures being implemented can have negative side consequences of a non-radiological nature for a population; for example, the relocation, as it follows from the experience available, may adversely affect the human health because of changing the social and other living conditions;
- the overall health protection approach in PER requires, in the context of the most efficient investments in health protection, to assess in an unified way - through risk analysis - the state of health as a whole, the background radiation as well as non-radiation risk factors;
- taking into account the acute, at all times, need for the social-psychological substantiation of the countermeasures (interaction with the local population, authorities and mass media), a proper scientific methodology must be available to perform a comparative assessment and analysis of various risks.

The effect of countermeasure implementation and the radiological consequences of living in contaminated areas can be expressed in terms of *avertable risk* and *residual risk*, both at the individual and the collective level. This way of communicating the overall situation might be more direct and understandable way than using radiological quantities. The development of methodology on risk analysis and risk communication in the framework of intervention should therefore have a high priority.

## CONCLUSION

Considering the further development of regulation the following steps should be made among others:

- development and adoption of the concept of using risk analysis in PER decision making,
- development of the concept "Probability of Causation" as a basis for decision making on relationship of cancer diseases and radiation exposure,
- development of recommendations on proper treatment of risk and dose uncertainties in PER decision making.

To put the optimization principle into practical application in PER the proper guidance for economic analysis of risk is needed considering overall health but not only radiation protection. The last point is especially actual for CIS/Russia: there effectiveness of health protection and rehabilitation is considerably higher than in USA, EU and other developed countries.

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