

EVOLUTION OF REGULATION RELATED TO THE CHERNOBYL ACCIDENT

L.I. ANISIMOVA
Ministry of Russian Federation for Civil Defence,
Moscow, Russian Federation



XA9745896

S.T. BELYAEV, V. F. DEMIN, V.A. KUTKOV
Russian Research Center "Kurchatov Institute",
Moscow, Russian Federation

1. INTRODUCTION

'Classical' principles of radiological protection are based on radiation doses, intervention levels and effective countermeasures. Clear and logical in principle, these basic parts need a specific clarification on each after-accident period. Being unavoidable and useful on the first early stage, 'the classical' principles and criteria meet specific obstacles in introduction and practical application on the next, long-term stage.

The 'classical' pattern of radiological protection considers mostly the radiation factor. The choice of protective measures is governed by effective doses, both received and projected, also established and adopted intervention levels, respectively. The effectiveness of the countermeasures is measured by the value of an averted dose.

The lessons learned from Chernobyl show that the above single-factor pattern of radiological protection is appropriate only at an acute post-accident phase. In that period (days and weeks after an accident) the radiation factor prevails and basic countermeasures are proceeded from pre-arranged intervention levels.

At the next long-term phase (months, years after the accident) there is enough time for a human factor to come fully into force. This factor implies the psychological and social acceptance, by the public, of the countermeasures to be implemented. It implies the response of the public to their implementation, the reflection of the situation by mass media, the reaction of Legislative and Administrative Bodies too.

2. EVOLUTION OF REGULATION RELATED TO THE CHERNOBYL ACCIDENT IN THE FORMER USSR

Former USSR had a great experience in off-site remedial actions in the case of severe radiation accidents at the Southern Urals. Unfortunately, that experience was not reflected in the Guides regulated protection of the public. Only intervention levels for early off-site countermeasures were implemented in the Emergency Plans and Guides [1]. They were realized on the early post-accident period [2].

The management of post-accident countermeasures in the former USSR was implemented under conditions when neither domestic guides nor recommendations of international organizations were not complete or perfect. The main problems arose especially in respect to measures at the intermediate and long-term phases. The Radiation Safety Standards of the former USSR - NRB-76/87 contained only one item, concerned with protection of the public in the case of radiation accident. According to it in the case of each accident the USSR Ministry of Public Health should

to establish the special requirements on the public exposure. The USSR Ministry of Public Health had the USSR National Commission on Radiation Protection as a consultative body in the field of radiation safety.

2.1. '35 rem' Concept

In 1988 the USSR National Commission on Radiation Protection developed the 'Concept of safe residence in populated areas contaminated after the Chernobyl accident'. That Concept was adopted by the USSR Ministry of Public Health on 22 November 1988 and is well known as '35 rem' Concept.

The Concept was based on using a lifetime dose as a measure of the lifetime radiological hazard. It should be noted that the Concept was a simplified reflection of the scientific and practical experience of that time and the situation established in 1988-1989 in the regions affected by the Chernobyl accident. In fact the Concept only corrected the intervention levels for relocation adopted in existed Emergency Plans [1]. The main principles and criteria of '35 rem' Concept are the following [3]:

1. To establish limit of the individual lifetime dose 35 rem applied to the summary doses resulting from external and internal exposures.
2. The observation of represented dose limit is regulated by the mean individual dose equivalent in the critical group of each populated area.
3. The fixed standard includes the doses, which the population had been exposed to since April 26, 1986.
4. The fixed standard does not include doses incurred from natural background radiation.

The lifetime dose intervention level was established to limit late health effects caused by radiation exposure. On the territories where the predicted lifetime dose would not exceed that value, the limitation withdrawal was suggested from 1990. In areas where it was envisaged lifetime dose intervention level of 35 rem would be exceeded, relocation should be made. In areas where it was envisaged that lifetime dose level would not be exceeded, no actions are required. The one level system of making decisions on protective measures would not allow any optimal use of the whole complex of possible protective measures.

2.2. Chernobyl 1991 Concept

In 1988 - 1990 the '35 rem' Concept was realized in some Governmental decisions on liquidation the consequences of the Chernobyl accident. But on 25 April 1990 because of hot discussion it was rejected by the Supreme Soviet of the USSR. The Soviet Government entrusted the Academy of Sciences with the examination of that Concept and all its possible alternatives. The goal of that work was to elaborate a synthetic position, which could be acceptable for the concerned Republics.

The Chernobyl 1991 Concept of protective post-accident measures was drafted by the end of 1990 and was approved on 8 April 1991 by the USSR Government [4]. Authorized Bodies of Belarus, Russia and the Ukraine worked out and adopted also their versions of the Concept, which were in main principle points very similar to the All-Union Chernobyl 1991 Concept.

The main goal of that Concept was the implementation of the clear dose principles in decision making on the late phase of the post-accident remedial activity. Main points of the Chernobyl 1991 Concept are the following.

1. The effective dose due to the Chernobyl accident shall be the basic index for making decisions on protective measures, their character and scale, as well as compensating for damages.
2. The excess (over the natural and technogenic radiation background for given locality) of the public exposure from the Chernobyl fallout is permissible. It doesn't demand any intervention if an average annual effective dose is lower than 1 mSv for 1991 and following years. At the level of 1 mSv and lower, the conditions of living and working activity of the population does not require any restrictions.
3. At a higher level than 1 mSv per year (over the natural and technogenic background), protective actions should be taken. Achievement of these goals should be optimized with the condition that an average individual effective dose equivalent does not exceed 5 mSv in 1991, with a maximum decrease of this limiting level up to 1 mSv in future.
4. Voluntary relocation can be reckoned among the countermeasures. Each person living in a contaminated territory shall have the right to make own decision about continuing to live in the given territory or going to another place of residence. That decision must be based on unbiased information about the radiation situation, socio-economic and other aspects of life. Any decision adopted should not give a direct economic advantage.

2.3. Resume

The Chernobyl 1991 Concept together with '35 rem' Concept could be the background for more appropriate regulatory documents to meet requirements for protecting the public in the case of radiation accident. Unfortunately, no steps were made on that way. In 1991 basing on the Chernobyl 1991 Concept the Chernobyl All-Union [5] and Republican Laws were worked out and adopted by the Supreme Soviets of the USSR, the Ukraine, Belarus and Russia. These laws turned out to be considerably different by some their principle points from the relevant Concepts and each other.

Since mid-1991 the practical activity on the elimination of consequences of the Chernobyl accident has been regulated by the Law [5]. However it became clear already in 1992 that the regulatory documents connected with both the elimination of consequences of the Chernobyl accident and other applications needed to be further improved and developed. It was caused by several reasons. Main of them are the following.

1. In the Law there are serious contradictions and unjustified principles that prevents from optimal implementation of long-term protection and restoration measures. In the first part of the Law [5] ('General Provisions') the public dose is taken (agree with the Concept [4]) as a main index for decision making.

It established that average annual dose equal to 1 mSv is acceptable and does not require any intervention (non-action level). Nevertheless inspired by these justified provisions another part of the Law is based on another index: a level of soil contamination by ^{137}Cs . This index was used for zoning the contaminated territories since 1986. According to the Law it must be used for decision making in the territorial zoning, population relocation and other countermeasures allowances and compensations. Between this index and the annual or residual doses there are no direct relationships.

2. The implementation of the Law created additional social problems. By the Law all territories with contamination as low as 1 Ci/km^2 were determined as 'suffered from the Chernobyl accident'. About 2,600,000 people lived on that territories in 1992. Annual doses for about 93% population of 'suffered territories' did not exceed 1 mSv in 1992 [6].

3. POST-ACCIDENT MANAGEMENT IN RUSSIA SINCE 1992

The Chernobyl 1991 Concept [4] and the Law [5] have limited application. They were relevant only to the situation, turned out in 1991 and following years in the regions affected by the Chernobyl accident. In Russia there are several contaminated regions besides the regions suffered from the Chernobyl accident. Since 1992 the issues of radiation protection, social rehabilitation and economic compensation in these territories have been under consideration by scientists and local and state authorities. The experience from these areas was used to reconsider the past recommendations on intervention strategy.

Considering these demands on improved regulation documents it was planned to develop in 1992 - 1995 new improved recommendations and guides on carrying out protection and restoration measures after nuclear accidents. The Russian NCRP, organized in 1992 by the Decree of the Government of the Russian Federation, and the Chernobyl State Committee began this work considering accidents occurred in the past and probable future ones. It was understood that in these documents one should

- consider as interacted all post-accident phases: early, long-term and a final restoration (rehabilitation) ones,
- develop in more details not only radiation but also social protection aspects.

A lot of items of the Chernobyl 1991 Concept became the 'points of growth' for new regulatory documents. Now two Concepts now are finished in development. That Concepts develop aspects of the Chernobyl 1991 Concept related to social (in more details - medical) rehabilitation of the suffered public. Briefly they were presented in the proceedings of the Minsk conference [2].

The first step on the generation new set of regulatory documents was the Altai 1993 Concept [7]. It was developed following the Russian Government commission (1992) decision to work out a program of rehabilitation of the public in settlements of Altai region, located in the zone affected by nuclear weapon tests on the Semipalatinsk Test Site. In terms of residual effective doses that Concept determined two categories of exposed persons and established the collective or individual social protection measures for them.

That Concept was developed and substituted by 'Concept of radiation, medical, social protection and rehabilitation of the public of the Russian Federation affected by accidental exposure' [8]. The main goal of that Concept was to make proposals on changing radiation, medical, social protection and rehabilitation strategy in the Russian regions suffered from the radiation accidents and nuclear weapons test many years ago. Medical and social protection and rehabilitation of the public in the Concept is based on the definition the cohort of exposed persons, cohort of persons, suffered from the accident and high risk cohort. That definitions are made in terms of life-span residual effective or equivalent doses. The collective and individual protection measures are specially envisaged for each cohort. The National Radiation and Epidemiologic Register was appointed as the organization base for all medical and social actions.

More general and principle regulation documents are now in the stage of preparation and adoption. One of the most important among them is the new Radiation Safety Standards for Protection Against Ionizing Radiation - 'NRB-96', prepared by joint working group of Belarussian and Russian scientists. That working group worked in a strong contact with NCRP of Russia and Belarus. That document includes chapter appeared as a result of analysis of our Chernobyl experience: 'Requirements to restriction the public exposure in emergency situations'. It includes the guidelines for intervention levels in emergency exposure situations on the acute and intermediate post-accident period. The special annex to that chapter has a requirements for zoning of the contaminated territories on the early, intermediate and restoration post-accident period.

In 1996 the adoption of the new Altai 1996 Concept is expected [9]. Its aim is to optimize the social and medical remedial measures for Altai inhabitants, suffered from the Nuclear weapon tests. The opportunity of optimization of the rehabilitation measures is based on development of the methodical approaches, computer database and codes by valuation of dose of a exposure, risk and health condition of the population. All this permits to evaluate consequences of the exposure with accuracy acceptable for medical practice. This may give particular, justified and address recommendations for realization of practical measures with use the regulatory documents on protective and restoration measures after the accidents.

The medical protection of the population against consequences of emergency exposure consists of a advance establishment of the persons, being direct carriers of the risk of realization of consequences of a exposure. The Concept has a requirements

- to formation from them the groups of increased risk;
- to prevention of potential stochastic effects;
- to application of radical measures at early stages of their manifestation.

The following three documents are now in work in the frame of the Russian federal research program (the Chernobyl case study):

- Recommendations on intervention levels and strategy of remedial actions after a nuclear accident;
- Recommendations on optimization of intervention and remediation actions after a nuclear accident;

- Recommendations on risk analysis in application to protection and remediation actions after a nuclear accident.

All these documents are coordinated one with others. The first versions (drafts) of them were adopted by Russian NCRP in December, 1994. The aim of that activity of Russian NCRP is the adoption of national experience of liquidation the consequences of large nuclear accidents and nuclear tests into the national practice of remedial actions and national radiation safety standards.

The main features of this new set of regulation documents are:

- combined consideration of all phases of post-accident activity,
- going outside pure radiation protection and taking into radiation as well as non-radiation risks,
- three sets of decision making dose levels,
- developed definition of a critical group, in which a possibility to receive not only the highest doses but also the highest risk is taken into account.

The system of Intervention levels includes THREE sets:

1. General Intervention Levels (in projected doses), which establish the strategy of intervention;
2. Specified Intervention Levels (in avertable doses and risks) of radiation protection;
3. Specified Intervention Levels (in residual doses and risks) of social protection.

The general intervention levels content two principal levels:

- upper dose level (the dose constraint) which demands to introduce any countermeasures not to allow to receive by people doses above this level;
- lower dose level which plays the role of a non-action level.

The development of these regulation documents will continue in 1996.

4. CONCLUSIONS

Now there is a real hope to have in coming future considerably developed and improved regulation documents of a new generation. One of the main task during their preparation is to learn all necessary lessons from the Chernobyl and other accidents, post-accident activity and results of relevant scientific research.

References

- [1] KONSTANTINOV, Y.O., Interventional levels in the USSR before the Chernobyl accident and early countermeasures, CEPN Report N^o 225, Centre d'étude sur l'Evaluation de la Protection dans le domanie Nucleare (CEPN), Fontenay-aux-Roses, France (1994) 29-58.

- [2] BELYAEV, S.T., DEMIN, V.F., KUTKOV, V.A., BARIAKHTAR, V.G., PETRIAEV, E.P., 'Characteristics of the Development of the Radiological Situation Resulting from the Accident, Intervention Levels and Countermeasures', (EC Publ N^o EUR 16544EN: Proc. Int. Conf., Minsk, 1996, Eds. A.Karaoglou, G.Desmet, G.N.Kelly, H.G.Menzel), EC, Bruxelles - Luxembourg (1996) 19-28.
- [3] The limit of an individual dose set for the population in the controlled areas of Russia, Belarus and the Ukraine exposed to the radioactive pollution as a result of the accident at the Chernobyl NPP, Bulletin of the Research Program 'Semipalatinsk Test Site/Altai' **3** (1995) 7 (in Russian).
- [4] A Concept of living conditions for people in the regions affected by the Chernobyl accident. Adopted by USSR Government on 08.04.91, Resolution N^o 164. The English translation: Concept of Safe Living Conditions for People in the Regions Affected by the Chernobyl Accident, Ibidem [1] 331-338.
- [5] The Law of Russian Federation 'On social protection of the public suffered from radiation exposure due to the Chernobyl accident', 15 May 1991.
- [6] Collected information and regulation documents belonged to liquidating the consequences of the Chernobyl accident in the Russian Federation. Explanatory notes, Inst. Nucl. Safety, Moscow (1993) 2-17 (in Russian).
- [7] GORDEEV, K.I., SHOIKHET, Ja.N., DEMIN, V.F., et al., Concept of rehabilitation of the public and normalization of ecological, sanitary and socio-economical situation in settlements of Altai region, located in the zone affected by nuclear weapon tests on the Semipalatinsk Test Site, Ibidem [3] 11-15 (in Russian).
- [8] Concept of radiation, medical, social protection and rehabilitation of the public of the Russian Federation affected by accidental exposure, Ibidem [3] 16-22 (in Russian).
- [9] GOLIKOV, V.,J., DEMIN, V.F., KEIRIM-MARKUS, I.B., KISELEV, V.I., KUTKOV, V.A., RESONTOV, V.A., STARINSKY, V.V., SHOIKHET, Ja.N., Concept of radiation risk prediction and planing of aid to the population of some territories of the Altai Region exposed to radiation as a result of nuclear testing at the Semipalatinsk Test Site, Ibidem [3] 23-41 (in Russian).