

PRINCIPLES AND CRITERIA FOR CREATION OF A CONCEPT FOR NATIONAL RADWASTE REPOSITORY

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The building of the first Nuclear Power Plant at Kozlodui in the Republic of Bulgaria put forward the problem for treatment and storage of radwastes generated by normal operation of the Nuclear plant. This is a complex and not yet solved problem on a world scale, but each country using NPP devotes substantial amount of money for development of long term programs for temporary as well as for final solution of this problem. The creation of a Concept for construction of National Repository for Radwaste Storage is an initial but basic element of the whole national system for radwaste management. This Concept puts a beginning of a complex and costly project including the investigations and participation of many people and different state authorities and institutions.

The creation of the Concept for National Radwaste Repository, assigned to the Bulgarian Academy of Sciences by the Government, implies principles and criteria based on international experience and requirements and also on the specific conditions in the Republic of Bulgaria.

The basic principles are:

1. Study of the international experience and requirements for construction of radwaste repositories.
2. Implementations of the methodology of the developed countries (EC, USA, etc.) which are ahead in solving this problem and also by taking into consideration the methodological requirements of IAEA (Commission of the European Communities, 1979; International Atomic Energy Agency, 1983, 1987).
3. Taking into consideration all concepts offered up till now for the radwaste repositories in Bulgaria.
4. Using all published and not published information in Bulgaria which has any connection with this matter and carrying out supplementary studies and investigations.
5. The selections of areas and sites has to be performed according to the principle of excluding with the use of specially developed criteria.
6. Elaboration of a detailed program and good organization in the Bulgarian Academy of Sciences for its qualitative realization.

The implementation of IAEA recommendations and analyses of the experience of the countries from EC, USA, etc. resulted in the development of criteria for assessment of areas and sites which are connected with a final repository for radwaste. The basic criteria have been internationally accepted and their content is not changed in the Concept. Some of the criteria are modified according to the conditions in Bulgaria, which has been done by all countries.

The criteria applied in the concept about the site selection of a radwaste repository can be divided in two groups:

Group A - overall criteria, used for categorization of country areas as prospective and nonprospective from the point of view of selecting a site for National Radwaste Repository.

Group B - criteria of semiquantitative and qualitative character used for assessment of separate terrains and objects. These criteria differ according to the repository type for low and intermediate or for high level radwaste.

The geological, geographical, seismotectonic, hydrogeologic, engineering-geological, hydrologic, climatic and socio-economical criteria can be assigned to Group A. For all the above mentioned aspects the criteria are developed in detail as requirements for the conditions in the country.

The criteria from Group B are developed for a semiquantitative and qualitative assessment of separate areas and objects which make possible the comparison of indices and the selection of the most proper site for radwaste repository.

The development and application of the basic principles and criteria will enable the creation of a "Concept for Radwaste Repository Construction" as a first stage term of the nuclear programme of the country. The Concept contains about 70 projects of common or more special character and it surpasses the volume and content of the set task. As a final result of the performed analyses, the territory of Bulgaria is categorized and several prospective areas are selected on the map of the scale of 1:500 000. These sites will be subjected to further investigations and preliminary studies in the second stage. Preliminarily thoroughly assessed sites are offered at the selected prospective areas, where repositories for low, intermediate and high level radwaste can be constructed.

The concept also contains a model for development of a National System for Radwaste Management (Scheme 1).

The principal scheme is assigned to show clearly the complexity of the problem and to mark the basic elements which should not be neglected or

not taken into consideration. When working out the scheme we had in mind that it shows basically the technical side of the problem which to great extent covers the social assignment. The scheme does not contain or slightly stresses on such important issues as the development of proper radwaste legislation, the preparation of the public opinion for the necessity of building repositories and above all - acceptance of long term national policy for the development of nuclear energy and taking adequate governmental decisions.

The development of the Concept for the construction of National Radwaste Repository has taken into consideration all IAEA recommendations, basic principles and criteria [1-5]. The main objective of the Radwaste Repository construction is the choice of a proper in properties and dimensions geologic formation, which will not permit for a long period of time any radioisotope release above certain acceptable concentrations to the biosphere and man. The evaluation of limit concentrations for each isotope as well as the limits for the dose burden of the population in the country or in a given region are prescribed by the Ministry of Health and they are periodically changed according to the recommendations of the publications of the UN International Commission on Radiological Protection (ICRP) [6-9]. When a certain type of repository is proposed for a given geologic formation, it should be proved to the competent authorities of the country - Committee for Peaceful Uses of Atomic Energy, Ministry of Health, Ministry of Environment, etc., that whatever happens, the radiological consequences for the population of the region as well as the change in the isotope concentrations in the environment will not go beyond the values of the normative documents. It is a world practice such proof to be based on calculations by internationally accepted computer codes which make possible the modelling of different processes and the probability for any accidents to take place together with the evaluation of the change in the dose burden of the region's population [10]

The final repository for radwastes is a complex and very expensive device which should isolate all radioactive isotopes from the biosphere and man for a sufficiently long period of time, after which their concentration will become relatively small due to the radioactive decay. It is clear that all radwastes should not be buried in one and the same repository. That is why the wastes should be segregated according to their source, specific activity, radionuclide content and volume into several big groups and they should be treated and stored depending on their type.

The NPP - Kozlodui is the major generator of radwaste. The generated waste by the normal operation of the utility can be divided in two main groups:

- a) Low and intermediate
- b) High level waste.

The wastes from the first group have low and intermediate specific activity, great volume and relatively constant chemical composition. Special industrial technologies are applied for the concentration and treatment of such type of wastes. After several years the main radioactivity in these wastes is mainly due to the isotopes of strontium and caesium, which require relatively short period (not longer than 300 y), necessary for the isolation of such wastes from the biosphere and man. Because of the great volume of these wastes, the choice of technologies for their concentration and treatment is most important.

The obtained high level radwastes can be divided also in two basic groups:

- Burned-up nuclear fuel
- Wastes obtained by the irradiation of construction elements.

The first group is the most serious type of radwastes. The technologies for their treatment and the site selection together with the technologies for the final storage of such wastes represent a very serious problem which has not yet been solved even in the developed countries. This type of waste is characterized by high radioactivity and high concentration of transuranium elements which possess very high radiotoxicity. Because of the high level of radioactivity in the fuel rods they have to be stored for a certain period in an interim storage after which they have to be treated at the final repository for the burned-up fuel. The choice of the geological formation where the final Repository and the supplementary engineer barriers would be constructed, should be made after careful studies and analyses [11-14]. because of the high radioactivity, high radiotoxicity and long half-life (thousands of years).

The high level wastes obtained after the decommissioning of the NPP have also large volumes, high specific radioactivity but relatively short period of half life - several years. The recycling of the metal and the choice of the repository will depend very much on the decommissioning technologies of the NPP.

In our opinion the problems connected with Bulgarian radwaste should be considered and solved on a sufficiently high governmental level. Any delay in their solution will result in a severe social collisions not only on regional but on national scale as well.

As a solution of the existing very complex situation with the treatment and storage of radwaste in the country we propose the formation of a

working group appointed by governmental authorities which will develop and organize in real terms the following:

1. Legislation basis regulating all aspects of the above problem - from financial-economical to environmental.

2. Long term concept and short term detailed programs for solution of all problems connected with the generated radwaste in the country.

3. Special structures which will take the responsibility and the exploitation of all facilities for decontamination and storage of radioactive waste in the country

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Principal Scheme for Radwaste Management

