

THE YUGOSLAV APPROACH TO THE PROBLEM OF RADIOACTIVE WASTE

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ABSTRACT

This paper discusses cooperation between two Yugoslav republics (states) and their approach to the solve an acute problem of radioactive waste disposal. This approach somewhat resembles features of U. S. compacts, i.e., two states coordinating their efforts and resources to resolve problems pertaining to the disposal of radioactive waste.

THE SOURCES AND AMOUNTS OF RADIOACTIVE WASTE

The largest producer of radioactive waste in Yugoslavia is NE Krsko, the country's only nuclear power plant. This plant is a two-loop Westinghouse design, pressurized water reactor. The plant's rated output is 632 MW and since commissioned in 1981 provides 17% of power for the two states that own it. Three research reactors and other laboratory equipment are additional sources of considerable amounts of radioactive waste. Other significant producers of radioactive waste include medical centers, industry, agriculture, government and some other institutions. Currently only low-and intermediate-level waste is present in the country. Spent reactor fuel is not reprocessed and is kept in fuel pools adjacent to producers.

According to Yugoslav regulations(1), a producer of radioactive waste is required to collect, classify, record and insure treatment, transport and storage of the generated waste. Radioactive waste is generally stored at the generator sites without any significant treatment. If the waste activity falls below the regulatory limits, it is released into the environment as a non active. If the radioactivity is above the stipulated level, the waste continues to be stored at the site of origin or is transported to a larger waste repository. In addition to the temporary storage at NE Krsko, Yugoslavia has five large and several smaller repositories for radioactive waste. These repositories are under the auspices of research institutions.

The total amount of stored radioactive waste in Yugoslavia is approximately 2500 m^3 , 90% of which is low activity waste. Assuming no increase in the waste production rate, the existing institutional waste repositories will be sufficient for the next fifteen or more years. However, the storage capacity of NE Krsko will only suffice for the next two or three years. The existing spent fuel capacities will be sufficient for the ten to fifteen years.

PAST ATTEMPTS TO SOLVE THE PROBLEM OF THE STORAGE OF RADIOACTIVE WASTE

During the last fifteen years, there have been many unsuccessful attempts to build the radioactive waste repositories in Yugoslavia. These failed attempts can be divided into two major phases. The first phase formally began in 1976 and was initiated by the NE Krsko investors as a part of a site licensing process. It finished with the local population's refusal to grant permission for further site characterization. The conclusion reached and decision was made at that time was that the waste disposal problem must be resolved at the country level. Current and future waste generators should take part in the program, also. The first phase concluded with the initiation of a second, which was subsequently formalized and introduced through a document - an agreement(2) on the joint solution of waste disposal problems at the Federal level. This was based on the assumption that a large number of nuclear power plants would be built in Yugoslavia. With the abandonment of such energy plans, the interest of the majority of the participants in joint ventures waned, and the entire problem eventually returned to the founders of NE Krsko, i.e., to the power industries of Slovenia and Croatia which had jointly built and operate NE Krsko.

In 1986 began a third phase. The program mission plan was based on major two premises:

- Temporary storage facilities at NE Krsko was filling at a higher rate than originally anticipated
- Unsolved problem of permanent disposal of radioactive waste might force owners to shut-down and eventually permanently close NE Krsko.

The degree to which the unresolved problem of radioactive waste storage adversely affects public acceptance of nuclear power is underlined by the fact that waste disposal was one of the arguments heard in the Yugoslav Parliament when the ban on a construction of new nuclear power plants was discussed(3). It is also one of the key

arguments in the ongoing proposal before the Yugoslav Parliament to cease further operations of NE Krsko.

PRESENT APPROACH

The present phase of repository activities is based upon an agreement between two power industries which own and operate NE Krsko(4). According to this document, utilities are responsible and obligated to finance and administer all activities required to organize and build a low-and intermediate-level waste repository. The repository will receive and store only the waste generated by NE Krsko. Other waste producers are taking preliminary steps to gain an open access to the repository. However, significant financial participation is not expected from research and medical institutions primarily due to their lack of funds. Their potential inclusion in the program is expected to increase public acceptance but the power industry is still reluctant to finance capacities that they will not necessarily use. Even though the situation with the institutional waste is not resolved yet, the regulators in both states requested that repository capacity should be sized in accordance with the following waste throughputs:

- All low-and-intermediate level radioactive waste which will be generated during the entire NE Krsko operating period, including the plant decommissioning.
- All low-and-intermediate level radioactive waste which will be generated from other sources up to the year 2050 in the states of Slovenia and Croatia.

Preliminary evaluations show that the total repository capacity through the year 2030 (end of NE Krsko operating life time) will be approximately 18,000 m³. However, all preparatory work will be conducted to allow future increase in repository capacity by 100%. This extra capacity is treated as a repository planned reserve.

Based on all previous activities conducted in Yugoslavia, as well as the experience of other countries, it was decided that all preparatory work should be performed for two types of repositories: shallow land and tunnel type. Conceptual designs have been prepared and site selection for both types of repositories is underway.

COORDINATING ACTIVITIES

Owing to the failure of two previous repository programs, as well as to a threat of closing NE Krsko, two states established a interstate coordinating body on a very high government level to monitor and guide the repository development program.

The members of this coordinating body are the state ministers for energy, environmental protection, planning, as well as the administrators of the state regulatory bodies for nuclear safety and presidents of the two power industries.

This body is presided over by the vice presidents of the governments of states.

Since the site selection proved to be of a crucial importance, the coordinating body has accepted the following strategy:

- In both republics, the most suitable sites for a radioactive waste repository will be selected through an independent but parallel and coordinated effort. These sites will be included in the states' urban planning documents.
- Special attention is to be devoted to development of methods and criteria for selecting and characterizing a sites.
- The decision for the construction of a common repository shall be made on the basis of the economic merits of the most suitable site in Slovenia and for the most suitable site in Croatia.

The present site selection activities are limited to the territories of Slovenia and Croatia. However, the assertion is often made publicly (generally without valid arguments) that it would be possible to store such radioactive waste more safely and cheaply in other parts of Yugoslavia or even other countries. Therefore, the coordinating body intends, without anticipating spectacular results, to seek formally an evaluation of such possibilities. A formal query has been addressed to the Yugoslav federal agencies, as well as to the international institutions (IAEA). The purpose of such activities is an attempt to remove one of the major hindrances to the realization of the repository project; i.e. public opposition to radwaste repository projects.

MANAGEMENT ACTIVITIES

The project team managing these activities is a separate department within the organizational structure of NE Krsko. The coordinating body is considering to remove the project team from NE Krsko and established it as an independent organization. Removing these activities from the power industry charter would help the project to gain public acceptance, i.e., to be treated as a project for the enhancement of human and environmental protection.

PUBLIC RELATIONS

The coordinating body insists on providing the public with complete and on-going information regarding the waste disposal program activities. Including the public in the social verification process is viewed by all program participants as a major step forward in comparison to the previous attempts. This is also deemed necessary prerequisite for the social acceptance of the entire project. The coordinating body regularly informs the public of its meet

ings. It also requires that various technical meetings and discussions be open to the public.

INCENTIVES

To make the eventual waste repository site acceptable to the public, the questions of compensation, incentives or rent paid to the local population is a very significant one. Until now, neither Yugoslav regulations nor practice have anticipated such a forms of compensating the local population for deterioration of the environment. The effort is perceived as honest and fair one. It will create an equitable and democratic system for compensating the inhabitants potentially exposed to the demonstrable negative effects such as: noise and dust during building, increased risk from heavier traffic, loss of agricultural land, reduction in the market prices of products or goods; or the nondemonstrable effects such as fear or other forms of irrational problems. The coordinating body will, following the elaboration of the questions of compensation, establish proposal for the manner and the amount of compensation, institute procedure for its verification and enact it into the law.

SITE SELECTION

Site selection is being carried out separately in both states. In Yugoslavia the individual states, rather than the federal government, have the authority and responsibility for environmental protection and land use planning. Therefore, the two states have somewhat different requirements in this matter.

The ultimate goal of establishing potential locations in each state is governed by the following general criteria:

- Selected site must be safe, i.e., repository will produce minimal environmental impact;
- Selected site must be technically/economically feasible;
- Selected site must be socially acceptable.

The major characteristics of the accepted site selection program are as follows:

- Interdisciplinary approach that includes all site related activities and all aspects of environmental protection;
- The phased site selection approach that includes the screening of the entire region, identification of potential area, selection of potential macrolocation and establishing several potential sites in each state for further characterization;

- The step-by-step approach regarding public hearing process that involves the verification of all significant procedures in the site selection aimed to avoid failure and achieve mutual trust between the professional and public regarding the proposed solutions.

After selecting several most suitable potential sites and including them in the planning documents, the problem of land use planning will cease to be the dominant consideration. It is superseded by the problem of nuclear safety, which will be resolved through a detailed site characterization(5). After selecting the optimal sites (based on the rational use of space and minimal environmental impact), the rigorous site characterization of these potential locations will be performed to select the most suitable one in each state. The final step in this process of selecting the most suitable location in each state will be establishment of a set of the site conditions and requirements that will be entered in the site permits.

Comparison of the investment programs will provide a decision elements to decide which of the two locations will be selected as a site for the future repository.

PERFORMANCE ASSESSMENT

One of the significant differences between the present and previous attempts to resolve radioactive waste disposal problem concerns the use of a systems engineering approach as an engineering management tool. In this approach, performance assessment is a controlling and integrating mechanism for all the interdisciplinary problems which arise. Such an approach insures uniformity in the data level throughout the development of the project. For the present, preliminary generic evaluations have been completed(6). These refer to two site characterization studies: one for shallow land burial and the other for tunnel storage. A preliminary sensitivity analysis was also performed as a part of the performance assessment study. The results have shown that both planned concepts can entirely satisfy the code limitations stipulated in the ICRP recommendations and the Yugoslav regulations(7).

WORK SCHEDULE

According to the existing schedule, the deadlines for the completion of certain key activities are as follows:

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| • Selection of potential sites | December 31, 1990 |
| • Interpolation into the planning documents | June 31, 1990 |
| • Issuance of site permits | April 30, 1992 |
| • Completion of investment programs | December 31, 1990 |
| • Comparison of the investment programs and decision on site | October 31, 1992 |

- Construction March 1 to December 31, 1992

Due to the high public involvement, it is very likely that this schedule will undergo radical changes.

It was estimated, at the government level, that the repository will not be constructed before the temporary waste storage facility at NE Krsko will be completely filled. Therefore, to make continued operations at NE Krsko possible, steps are being taken to expand the existing onsite storage facilities as well as reduce the plant waste generation. A separate report on this subject will be presented at this Symposium(8).

NONRADIOACTIVE HAZARDOUS WASTE

The storage of nonradioactive hazardous waste in Yugoslavia has been unsatisfactorily handled due to the industry ignorance and virtually non-existent regulations. The impact on the environment is much more serious than that of radioactive waste. Therefore, the question can justifiably be raised whether the same principles applied to the management of radioactive waste can be applied for nonradioactive hazardous waste. Some analyses reveal that there are many arguments that could justify such an approach(9).

If common principles are applied, radioactive and hazardous nonradioactive wastes could be stored at the same site. Such a solution is justifiable insofar as the amounts of waste for storage are not large.

For small countries, a common repository is justifiable considering the rational use of generally limited resources, space and specialized personnel. On the basis of such arguments, the two Yugoslav states are considering the possibilities of constructing the repositories for radioactive and nonradioactive hazardous wastes. The preliminary plan is to build one in each republic. The other possibility is that one state build a repository for radioactive waste and the other for nonradioactive waste that will serve both states. The recent scandals regarding the illegal transport of non-radioactive hazardous wastes across national boundaries in Europe will certainly increase the Yugoslav public's concern regarding all types of hazardous waste. It will also increase public awareness regarding the storage of waste from one republic in another. Therefore, we believe that there is a greater chance that repositories for both types of hazardous waste will be constructed separately in each of the republics.

CONCLUSION

The problem of storing the radioactive waste in Yugoslavia is being solved slowly. It is accompanied by a series of difficulties typical for other countries, especially public resistance to potential repository sites. In such a situation, it is expected that concerted efforts will be directed toward the public relations concerning such projects. The problem

of environmental threats, which is receiving increasing public attention, produces a good climate for the solution of the problem of the storage of hazardous wastes. In such a situation, it is necessary to monitor what is happening in other countries and take advantage of their positive experiences and new insights.

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