RADIOACTIVE WASTE MANAGEMENT IN HUNGARY AT THE TURN OF THE MILLENNIUM II.

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ABSTRACT

The paper describes the challenging situation related to the radioactive waste management in Hungary. It is also discussing the legal and financial background and overviewing the developed strategy and the steps to be taken to find a reliable and safe disposal for L/ILW.

INTRODUCTION

At the turn of the millennium, the Hungarian economy can hardly be imagined without nuclear technology which has been applied in a fairly wide scale in the agriculture, industry, medicine and it is determinant in the production of electric energy. The domestic use of the nuclear technology offers significant economical advantages mostly in the electric energy industry, where more than 40 % proportion of the nuclear power in the total production keeps the consumer's price at an acceptable level.
The rising use of the nuclear technology however forces the society to tackle several problems. Of these challenges it is the disposal of radioactive wastes and decommissioning of the nuclear facilities that very often stirs emotions and provokes heated debates. The concerns should be dealt with and feasible solutions have to be found.
In recognition of this, in 1996 the Parliament of the Hungarian Republic enacted the law on atomic energy which provides that the performance of tasks related to the radioactive waste management and decommissioning of nuclear facilities will be accomplished by an organisation designated by the Government.
There are four technical priorities for the coming years such as improving the existing repository, construction of a new repository for short–lived waste (L/ILW), extension the interim storage capacity for spent fuel and selecting a site for a high–level waste repository.
At the same time it is of utmost importance to form and maintain good relation with the public during the realisation of these projects. The experience has shown that in the past the nuclear energy's weak point has often been a lack of transparency together with inadequate communication and dialogue with the public. In the future, the key element in the implementation of radioactive waste management programmes should be the openness and co-operation with the public.

Legislation and Organisational Structure

The new Act on atomic energy regulates – among others – the performance and financing of tasks related to the radioactive waste management and decommissioning of nuclear facilities. In this respect its basic principles are in conformity with the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management.
The Art. 40 of the new Act stipulates clearly as regards the radioactive waste management and the decommissioning of the nuclear facilities: "Final disposal of the radioactive waste and interim storage of the spent fuel, together with the activities related to the tasks of decommissioning the nuclear facilities shall be dealt with by an organisation appointed by the Government, as their solution is a national interest." According to the Article 62 of the Act, financing the tasks mentioned above shall be provided from the Central Nuclear Financial Fund.
The Government, in its Decision N^{o} 2414/1997 authorised the Director General of the Hungarian Atomic Energy Authority (HAEA) to establish a company entitled as "Public Agency for Radioactive Waste Management" (abbreviated as PURAM). The deadline was July 1, 1998. According to this Decision, PURAM takes over the tasks related to collection, treatment, transport, storage and disposal of radwaste of small scale producers from the National Public Health and Medical Officer Service and at the same time the operation of the repository at Püspökszilágy is also handed over to PURAM.
In order to regularly provide information to the population of the communities in the vicinity of the facilities, the licensee of a nuclear power plant as well as that of a radioactive waste disposal facility shall promote the establishment of a public control and information association and can grant assistance to its activities. Consequently, the law established the legal basis of providing financial incentives for the supportive group of municipalities.
Considerations of social-political issues concerning radioactive waste management are given in the Act on Environmental Protection (1995. LIII.). The Act requires assessment of impacts of – among others – major waste management activities in the form of Environmental Impact Assessment. (EIA). The Act calls also for hearings of citizens in local and neighbouring municipalities and other interested groups.

Cost and Financing

Before 1998, reserve fund for the future costs of nuclear waste management and decommissioning of nuclear facilities was not set up in Hungary.
The new Act provided for the Government to take steps aimed at setting up a financial system to implement a coherent and comprehensive solution for the back-end of the nuclear fuel cycle and disposal of radioactive waste.
All costs for managing and disposing of radioactive waste and spent nuclear fuel must be paid by the waste producers. The member of the Government, who supervises the HAEA, is responsible for the operation of the Fund – as the dispose of the Fund – and through the HAEA – as the manager of the Fund – provides of carrying out the management tasks associated with the operation of the Fund.
The licensee (or, in the case of budget funded organisations, the budget) is liable to cover the costs of the final disposal of radioactive waste, as well as the interim storage and final disposal

of spent fuel. For this purpose the Central Nuclear Financial Fund was established. The Fund is a separate State fund exclusively earmarked for financing the construction and operation of facilities for the final disposal of radioactive waste, as well as for the interim storage and final disposal of spent fuel, and the decommissioning of nuclear facilities. Payments into the Fund by licensees of nuclear facilities will be determined in such a way that the Fund will fully cover all the costs arising from the waste management, both from the operation of the facility and its decommissioning. In case of the nuclear power plant, payments made by the licensees to the Fund should be taken into account as expenditure when pricing electricity. In order to ensure the stability of the value of the Fund a certain amount of money is provided from the Government's budget calculated on the base of real rate of return.
The payments into the Fund started on January 1, 1998.

Sources, Types and Quantities of L/ILW

In Hungary, the significant use of open and sealed sources of radioactivity began during the second half of the 1950s. A research reactor was commissioned at 1959 in the Central Research Institute for Physics in Budapest. The first nuclear power plant unit went into operation in 1982.

In Hungary, two main groups of institutions generate L/ILW; the first group (small-scale producers or non-fuel cycle) includes hospitals, laboratories and industrial companies. Nowadays, the number of these institutions is about 500-600. The other main waste producer is the Paks Nuclear Power Plant.
The first group generates about 13-30 m^3 L/ILW per year at present. This amount includes 10-25 m^3 solid, 2-3 m^3 liquid, 1-2 m^3 biological waste and 500-1000 spent radiation sources.
The solid waste is generally packaged into drums or plastic bags, the liquid waste and biological one are put into cans or drums, the spent sealed sources are handled with shielding container. The plastic bag solid wastes originating from the first group are repackaged into drums by the disposal facility. The liquid waste is sponged up with siliceous marl or cemented. In earlier stage the biological waste was bituminized into drums, at present this is also cemented. The main types of radioisotopes found in the wastes are H-3, C-14, Na-22, Mn-54, Co-60, Cs-137, Pm-147, Ir -192, Tl-204, Ra-226, Am-241.
The wastes are to be stored by the producer on-site under special circumstances waiting for the collection and removal to the disposal site. The producer has to provide information about the radwaste to the disposal facility. This information consists of the activity level, main physical and chemical compounds, dose rate at surface of package.

Radwaste management related to the NPP waste is the next: waters of high salinity are treated by evaporation; the steam produced is condensed and cleaned through ion-exchange resins. The annual accumulation of evaporator concentrates has so far been 200-250 m^3 for the four units. Evaporated water returns back to the process, or it is released into the river Danube. Evaporator concentrates are transported by pipeline to the liquid waste storage tanks. Conditioning of the evaporation concentrate has not started yet. Following the boric acid recovery and Cs filtration, the residue is planned to be cemented.
Waters of low salinity leaving the process cycle are cleaned through ion-exchange lines. Average production of spent ion-exchange resins is 0.6 m^3/y for the four units. The annual

amount of other miscellaneous active liquid waste (oils, organic solvents) is around 0.5 m^3/unit. The spent resins are subject to cement solidification.
Compactable solid LLW at nuclear power plant is collected in 50-litre welded polyethylene bags. The solid waste in bags having a dose rate at the surface less than 30 μSv/h is pre-treated by using a segregation box, and then the waste below 1μSv/h is handled like a clearance one. The rest of solid waste is placed in 200-litre steel drums and compacted. The volume reduction factor is about 5. Metal L/ILW with sharp edges is collected directly in drums. The annual accumulation of dry solid wastes after treatment is less than 120-140 m^3 for the four units.

Site Selection for a New L/ILW Repository

The Hungarian State Geological Institute started studying the available data to identify potential areas for the disposal of low and intermediate level radioactive waste in 1993. The criteria had been set prior to the commencement of the survey although certain technical issues have been discussed in the course of the work.
Initially, inspired by the US experience, the whole process of site selection was subdivided into three stages: exclusion of unsuitable areas; selection of potential sites; selection of disposal site.
Unsuitable areas have been excluded by various screening criteria such as a certain distance from the border of the country, significant historic sites and national memorials, national parks and nature conservation areas, certain recreational areas, dangerous industrial and military objects, oil and gas pipelines, drinking water resources and mineral deposits, earthquake focal areas and active geological faults.
The further exclusion has been performed separately according to the requirements of the two proposed disposal methods (near surface and geological disposal).
According to the preliminary sketch made after the first stage of the site selection process (the exclusion of unsuitable areas), approx. 6000 km^2 of the country seemed suitable for housing a near surface repository and about 23000 km^2 for geological disposal. That is a bit less than one third of the total territory of Hungary.
32 such geological objects have been found suitable for further investigations concerning near surface disposal of low and intermediate level radioactive wastes and 49 for geological disposal.
The next step to be taken was much less obvious. The second sub-stage of the object selection consisted of a more precise study of the available data on a limited amount of objects.
Once the exact location of the suitable geological objects was know, a decision had to be made on which of them to study in detail. There were three independent factors to be taken into account. The first is the geological characteristics, the second is the technical feasibility (site access and constructability) and the third is the public acceptance. The performance of each site could be scored in respect to these factors. The ideal situation would have been if the same site was found the best on the basis of each consideration but this was not the case.
Thus the factors had to be weighted and this could not be done on a scientific basis but a political decision was required.
The concept adopted is that public acceptability must prevail over the other two considerations. In-situ investigations were to be only started in case of voluntary acceptance by the communities concerned. A letter was sent to each community in the regions concerned to offer them the opportunity of participating in the project.

The first letter was only introductory and informing the mayor about the project, nothing had to be decided on. Great emphasis was put on explaining to them that the repository unit will only be built in a village where most of the residents agree to it.
Those, who formally expressed interest, were involved in the next phase of the programme. Information sessions were held for learning more about the LLW/ILW disposal and the siting process. Through a consultative process, attempts were made to ensure that all interested and potentially affected people were fully informed and were given the opportunity to express their views and have their concerns addressed. In addition, the experts informed the people of the technology options available and the possible benefits. Later information sessions were conducted to describe the major elements of the process. The emphasis at these information sessions was on explaining the nature of the radioactive materials to be disposed of, the potential risks, and the role of the community in the process.

Resulting from these studies, the management of the programme selected the preferred site /Üveghuta-Bátaapáti/, where the geological site characterisation started in the second phase of the project.
The second phase of the project consists of three stages:

- selection of a site in granite massif,
- assessment of the geological suitability of the selected site,
- characterisation of the selected site.

The first stage of the second phase consisted of a geological evaluation of five areas in the neighbourhood of the original Üveghuta borehole. This evaluation was completed by 1997 and a site at was selected for study in stage 2.
The second stage comprised drilling of four deep boreholes, which were fully cored and logged. The stage 2 fieldwork was completed in 1998 and reporting on the work and developing safety assessments was finalised in September 1998. On completion of the 1997/98 investigations and interpretation a further safety assessment are being performed and this will form the basis for the decision concerning the suitability of the selected site for an underground repository for L/ILW and whether it merits further, more detailed, site characterisation (stage 3) is yet to be decided.
The next stage of the repository development comprises detailed site characterisation. However, scientific dissension has made the situation quite uncertain and a political debate has emerged. To promote achieving consensus, in 1999 the International Atomic Energy Agency was approached to organise a mission to carry out a peer review for the validation of the activities and results of the site selection and to give recommendations based on international good practice. The principal conclusions of the expert team's review were that the process that led to the selection of the preferred site appears reasonable and has appropriately considered both the Hungarian geology and public acceptance.
In June 2001, the Minister in charge approved the research plan for the next 4 years, hence the site characterisation and repository design is continuing on from 2002.
The facility is envisaged to be located in a granite formation in a hillside. The long-term safety of the repository relies primarily on the technical barriers in combination with slow water movement in the granite host rock.
Based on the existing information about the geological situation at the site for a rock mass of the type to be expected at Üveghuta, a "design as you go" approach is being followed, adapting

the design of the repository to the geological situation, as revealed during excavation. The safety assessments that were based on limited early geologic investigations should be updated. There is a need for an integrated safety assessment using the currently available site and conceptual design information, and including a broader spectrum of scenarios. This integrated safety assessment should form the basis for continued site characterisation.

In Hungary, progress with L/ILW siting to date reflects a gradual realisation of the need for public acceptance. In the early phase of the new siting process the fundamental aim of all actions, events and programmes was to establish a long-term relationship between the local communities and the project management and to continuously keep the local residents interested and confident in the development. The basis of the partnership is the trust of the local residents. In the course of the on-site investigations, a public information programme was continued. Besides the local municipalities involved, the neighbouring villages were also kept informed. Information was provided to the press and the scientific community in an organised manner.
On April 1997, six municipalities in the immediate vicinity of the potential site founded their own Public Control and Information Association, under the acronym, TETT. In 2000 one more municipality joined the Association. Although one neighbouring municipality has not joined, the level of acceptance can be judged as very good. Of course, full consensus and support is not a realistic objective. Since its establishment, the TETT has closely followed the site investigations, maintained contact with the project management and kept their own and the adjacent municipalities informed about developments.
In the final report of the international peer review (WATRP) special mention was made of the public relation activities carried out so far. The statement reads as follows: "The process that led to the selection of the Üveghuta site appears reasonable and has appropriately considered both the Hungarian geology and public acceptance. Based on a meeting with local representatives, an open communication programme appears to have been established."

SUMMARY

Hungary, being a candidate state to the European Union, pays particular attention to the measures that are typically considered as good practice within the EU when developing and implementing its national programme for the safe management of spent fuel and radioactive waste.
The Public Agency for Radioactive Waste Management (PURAM) has been designated to carry out the multilevel tasks associated with the disposal of radioactive waste, interim storage and final disposal of the spent fuel, as well as with the decommissioning of nuclear facilities. In accordance with changes in infrastructure, Hungary is about to make significant strategic and technical decisions. There are several technical priorities for the coming years, such as improving the existing L/ILW repository, construction of a new repository for L/ILW, extension of the interim storage facility for spent fuel and setting up a revised back-end policy. Preparations for decommissioning of the nuclear facilities have to be developed as well.
Technologies have been developed and the money is available in Central Nuclear Financial Fund. But we cannot accomplish these tasks all by ourselves. We must have the support of the nation and individual citizens. Therefore we will only build the repository on the site that is safe and where it is accepted by the local community. To accomplish the tasks properly, we

implemented a QA system. The system pays special attention to meeting the requirements arising from nuclear safety, radiation protection and environmental protection. We believe that the new system will result in our handling of the matters more reliable and effective. The Management would not only operate the QA system, but takes care of its further development.

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