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

S. Pellet, A. Temesi
National Research Institute for Radiobiology and Radiohygiene, Hungary
P.O. Box 101. H-1775 Budapest, Hungary

A. Fritz
Public Agency for Radioactive Waste Management
P.O. Box 12. H-7031, Paks, Hungary

ABSTRACT

The paper deals with the Hungarian radioactive waste management practice from the beginning up to now. It gives a historical overview which is extended with the detailed description of activity of the present temporary waste disposal facility in Püspökszilágy. In addition the plan for improving of the facility is also discussed.

INRODUCTION

Use of radioactive material in the major application fields as medicine, agriculture and industry has been started in the middle of 50's in Hungary. 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.

HISTORICAL OVERVIEW

In 1960, a temporary waste disposal facility was set up at Solymár in the northwestern outskirts of Budapest. About 900 m^3 of low level waste was stored there in 3-4 m deep concrete wells. As the site proved to be inappropriate for long-term disposal, the Hungarian Atomic Energy Commission (HAEC) decided to establish a new radioactive waste disposal facility. In December 1976, the Radioactive Waste Treatment and Disposal Facility was commissioned some 40 km northeast of Budapest, near the village of Püspökszilágy. In 1980, the Solymár site was cleaned up and closed by transferring all waste to the new facility.
Before 1998, the collection, transportation and disposal of waste were provided free of charge to the institutions those generate the waste. However, since setting up the Central Nuclear Financial Fund in 1998, the waste producers have been required to pay for this service.
The Püspökszilágy Radioactive Waste Treatment and Disposal Facility is located in Hungary, about 40 km NE of Budapest. The facility is located on the top of a hill near the village of Püspökszilágy. The repository is a typical near-surface engineered facility consisting of concrete vaults and steel-lined wells for the disposal of spent sources. Some waste in the vaults has been backfilled with cementitious material; other wastes are not yet backfilled. The vaults and wells are located above the water table in the unsaturated zone within a series of

heterogeneous Quaternary rocks. The facility has been used to dispose of low- and intermediate-level wastes from the pilot Solymár repository, operational wastes from the Paks NPP and various institutional wastes from research facilities and hospitals in Hungary. A particular feature of the site is the disposal of a number of spent sealed sources in steel-lined wells.

The extension of the activity from 1983

In 1983, the Püspökszilágy site was permitted to dispose of low level solid radioactive wastes from the Paks NPP until the opening of the power station's own disposal facility. Unlike other waste producers, the Paks NPP was charged for this service and was also required to build as much disposal capacity as was used. However, due to extremely strong public opposition, a license was not granted for the construction of additional capacity and also the population of Puspökszilágy and Kisnémedi, the two villages near the Püspökszilágy repository started to protest against the disposal of wastes of nuclear power plant origin. Therefore, the disposal of these wastes ceased temporarily in 1989. By that time, 1250 m^3 of radioactive waste had been sent to Puspökszilágy from the nuclear power plant. After negotiations, and a referendum at the villages in question, the NPP managed to reach an agreement to dispose of another 1000 m^3 of wastes at Puspökszilágy in the period until 1994. The waste shipments from the power plant restarted in 1992 and continued until 1996.

The Püspökszilágy disposal facility was required to accept institutional radioactive wastes and treat and dispose them in a proper manner. However, no waste acceptance criteria were put in place. At the request of producers, spent sealed sources were accepted for disposal. However, it is noted that the facility has not been required to accept all types of spent sealed sources for disposal. Radium sources (needles, capsules, etc.) have been collected and are currently being stored at the Püspökszilágy repository.

Overall, solid and solidified wastes have been emplaced to date in a disposal volume of 4,900 m^3, of which 2,500 m^3 is waste from the Paks NPP. The facility was extended in the late 1980's.

THE PRESENT

Inventory and the structure of the disposal facility

At present, the repository has only a temporary licence since the Hungarian Geological Survey, one of the authorities participating in the licensing procedure, has not consented to the issue of the permanent license. The new vault extension has been granted a limited operating license until the end of 2002.

The total activity of the waste stored at Püspökszilágy was made at the end of 2000 and is listed in the Table 1 below. The total volume of solid and solidified waste is estimated at 4800 m^3.

Table 1. The total activity of the waste stored or disposed

WASTE TYPE	ACTIVITY (Bq)
Solid	$7.78\ 10^{13}$
Liquid	$2.90\ 10^{12}$
Biological	$3.25\ 10^{11}$
Spent Sources	$6.14\ 10^{14}$
Total	$6.95\ 10^{14}$

The disposal units are divided into four categories:
Two types of vaults are designated as 'A' and 'C' (see Table 2).

Table 2 – Concrete Vaults

TYPE	NUMBER OF COMPARTMENTS	CAPACITY OF EACH COMPARTMENT
'A'	48 (I) and (II)	70 m³
	6 (III)	140 m³
	12 (IV)	70 m³
'C'	8	1.5 m³

Two types of wells, 'B' and 'D' are mainly reserved for the disposal of high activity sealed sources (see Table 3).

Table 3 – Wells

TYPE	NUMBER OF UNITS	SIZES
'B'	16	∅ 40 mm x depth 6000 mm
	16	∅ 100 mm x depth 6000 mm
'D'	4	∅ 200 mm x depth 6000 mm

The different disposal units are as follows:
'A'- type vaults

The "A" type disposal system consists of four vaults (I to IV). The original two vaults contained 48 compartments of 70 m^3 each. Vault AIII contains six compartments; each of 140 m^3 and Vault AIV contains 12 compartments, each of 70 m^3 volume.
Both unconditioned and conditioned wastes packaged in plastic bags or metal drums were placed in the disposal cells and eventually grouted *in situ* using low active contaminated grout. This practice was later changed with the use of uncontaminated grout. Grouting has now ceased, to enable retrieval of the waste drums at some time in the future if desired.
The two original vaults have already been sealed and temporarily covered with a 2m thick layer of soil.

'B' Type wells

The "B" type cells consist of 16 wells with a diameter of 40 mm and 16 wells with a diameter of 100 mm. The wells are stainless steel lined and 6 m long, located inside a concrete monolith structure. These wells were designed to receive high activity ^{60}Co sources, but the wells have also been used for other sources. It was the initial practice for the sources to be placed in the wells and then grouted in position. However, grouting is no longer practised in order to facilitate possible future retrieval.

'C' Type vaults

The "C" type disposal system consists of 8 vaults, each with a volume of 1.5 m^3. The cells are used for the disposal of contaminated organic solvents, which have an activity level above the relevant exemption level for incineration. This material is normally placed in cans, which are then placed in drums for disposal. This waste may also contain some used scintillation liquids.

'D' Type wells

The "D" type disposal system consists of 4 wells with diameter of 200 mm. The wells are steel lined and 6 m long. These cells have been utilised for disposal of spent radiation sources with a half-life of greater than 5 years.

Fig. 1. Landscape of the Püspökszilágy repository

Waste Treatment

The so-called 'Active building' contains laboratories and a waste sorting area with storage tanks for the collection of liquid wastes. The sorting facility is not in use and the liquid storage tanks are empty and may be dismantled to provide an additional storage facility.
The solid waste is generally packaged into drums or plastic bags, the liquid wastes and biological wastes are disposed in cans or drums, the spent sealed sources are emplaced in the A vaults inside a container, but generally emplaced in the wells after being transferred from the transport container. Solid wastes received in plastic bags are now repackaged in drums at the disposal facility. Liquid wastes are mixed with siliceous marl or are cemented. Originally, the biological wastes were mixed with bitumen in drums; at a later stage some of these wastes were also cemented.
The Püspökszilágy disposal facility was required to accept institutional radioactive wastes and treat and dispose them in a proper manner. However, no waste acceptance criteria were put in place. At the request of producers, spent sealed sources were accepted for disposal. However, it is noted that the facility has not been required to accept all types of spent sealed sources for disposal. Radium sources (needles, capsules, etc.) have been collected and are currently being stored at the Püspökszilágy repository. In the early years, the Püspökszilágy repository accepted ^{238}Pu and ^{239}Pu sources for disposal. However, this practice has been terminated and Pu sources are now collected and stored at the Isotopes Institute.

Sources of the waste deposited

To date, over 5000 consignments of radioactive waste have been delivered to Püspökszilágy from 480 different consignors. This includes:

- waste from Paks NPP. A total of 321 consignments with a volume of 1580m^3 were delivered to Püspökszilágy between 1983 and 1996 and placed (along with waste from other waste producers) in compartments a25 to a63. The waste is in bags or metal drums. A large number of drums (~500) were analysed using assay equipment at Paks. This has resulted in accurate information and little uncertainty over the properties of this waste stream;
- long-lived (other than ^{10}Be and ^{63}Ni) spent sealed sources (SSS). These consignments comprised of the following radionuclides; ^{14}C, ^{36}Cl, ^{40}K, ^{99}Tc, ^{129}I, ^{210}Bi, ^{226}Ra, ^{232}Th, ^{234}U, ^{235}U, ^{238}U, ^{237}Np, ^{238}Pu, ^{239}Pu and ^{241}Am, along with neutron sources containing, ^{226}Ra, ^{238}Pu, ^{239}Pu and ^{241}Am mixed with beryllium;
- waste from the original Solymár repository. These first 990 consignments to Püspökszilágy were placed into the first 'A Type' vault;
- long-lived waste other then SSS (for example, biological waste, contaminated water, solvents and other miscellaneous solid waste).

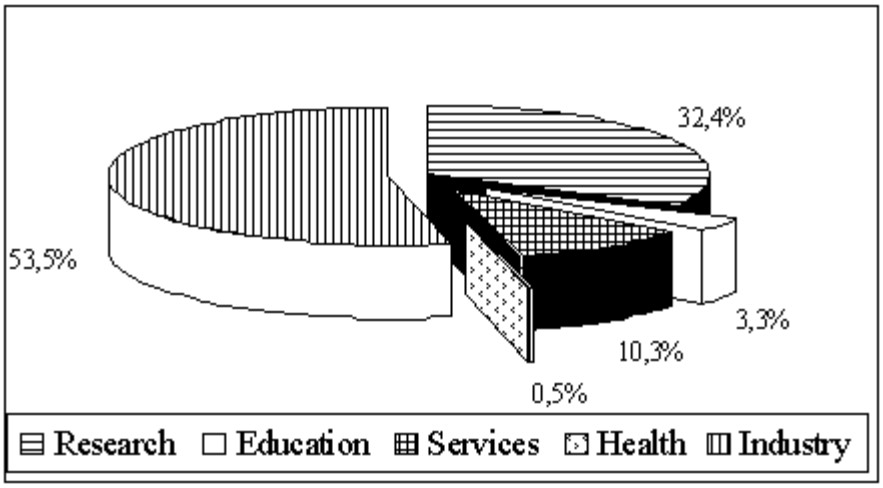

Fig. 2. Distribution of the disposed waste on different categories of producers

Half-life	Activity (GBq)	Percentage
< 5 years	5.3244E+04	6,81%
5 – 30 years	7.0586E+05	90,29%
30 - 100 years	3.374E+03	0,43%
100 - 600 years	7.470E+03	0,96%
> 600 years	1.1806E+04	1,51%

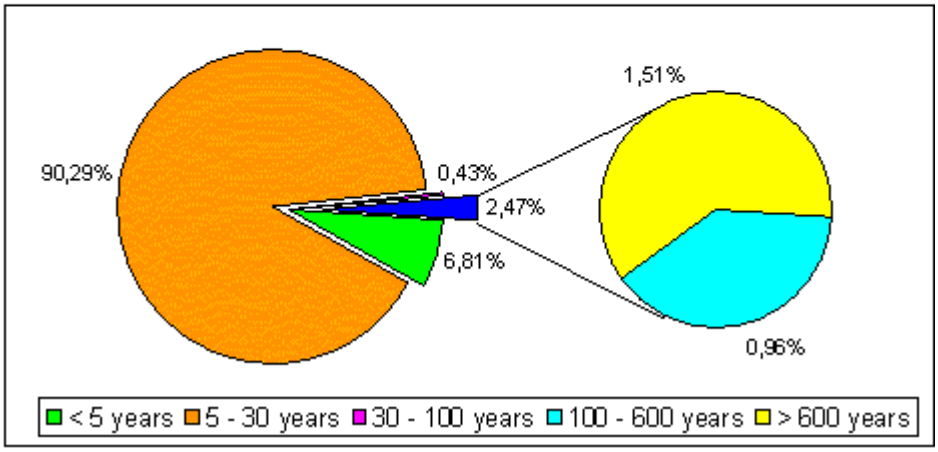

Fig. 3. Distribution of the disposed radionuclides based on half-lifes

Waste has been received from 480 organisations. These can be divided into six different categories based on the operational activity of the consignor, namely, industry (including Paks NPP), health applications, research, university (education), services and others.

The future of the repository

The repository is a typical near-surface engineered facility consisting of concrete vaults and wells for the disposal of spent sources. Some waste in the vaults has been backfilled with cementitious material; other wastes are not yet backfilled. The vaults and wells are located above the water table in relatively impermeable rock. It is envisaged that a number of operations would be carried out before closure of the facility including the emplacement of a clay layer over the vaults and the backfilling of wastes within the vaults.
The future development of the Püspökszilágy facility is unclear. A firm basis is required to support decisions concerning the future development. The safety of the Püspökszilágy facility has not yet been the subject of any comprehensive assessment. In the past, the Hungarian Geological Survey has opposed issuing a permanent license, on the grounds of geological suitability. Currently a program of work is recommended, which includes the completion of a comprehensive safety assessment. This would provide a view on the safety of the facility based on work undertaken by local and Western experts. This assessment would conform to international best practice as set out by the International Atomic Energy Agency (IAEA) and Nuclear Energy Agency (NEA).
In addition to a comprehensive safety assessment of the facility, consideration will be given to possible developments at the site. Developments could include:

- the removal of certain waste types from the site;
- remedial measures to improve safety related to wastes that are currently disposed;
- the disposal of further wastes and expansion of the existing facility.

Based on the performance assessment calculations undertaken for closure of the existing repository, the implications of such developments to post-closure safety will be examined.

One of the objectives with regard to the development of the Püspökszilágy repository has been to upgrade the physical state of the facility and to provide better conditions for further operation. The main areas of the upgrading activities were as follows:
Physical protection (new fence system, new access control, new equipment for the security guard), radiation protection (replacement of the obsolete measurement devices, enhancing of environmental monitoring), data acquisition (new data recording system, waste characterisation capability, new meteorological station), transportation (new transport vehicle and containers).
Repair and improvement of the buildings, refurbishment of the entire electrical supply and reserve electrical supply system, water supply, specialised sump water collection and ventilation systems, decontamination facility, improvement of the fire-fighting system make the modernisation activities complete.
The other main objective of development at the repository site is to make preparations for conversion of the existing treatment building of the Püspökszilágy repository into a centralised interim store for institutional radioactive waste, which are not meant for near surface disposal. The treatment building was designed in the seventies to treat and condition raw radioactive waste from isotope applications but remained unused. The centralised interim store can also serve as a "buffer storage", especially in cases when an urgent need may arise to receive a larger amount of waste at the repository site.

As the temporary licence of the extended part of the repository expired on the 31 December 2000, the regulatory body set as a condition for issuing the permanent licence to conduct a: comprehensive Safety Analysis (SA). Two safety analyses were completed: One was performed by ETV – ERŐTERV, while the other one was made by AEA Technology of the UK in a project, funded under the European Commission PHARE programme.

SUMMARY

Based on the results of the safety assessments, the safe operation of the repository, as well as the safety of the environment, is guaranteed till the end the passive institutional control period. Having identified the key issues and uncertainties in the assessment, further work will be undertaken to resolve these issues and uncertainties, leading eventually to a position in which full assurance of the post-closure safety of the repository can be provided. This further work is likely to involve changes in the characteristics of the facility, updating of plans for its closure and enhancements of the methods used to evaluate its post-closure radiological impact. A medium-term programme has recently been set up by PURAM, which designates in detail the tasks to be performed.