STATUS OF THE RADIOACTIVE WASTE PROGRAM IN HUNGARY

Sandor Pellet, Peter Ormal, Elemer Viragh
Hungary

ABSTRACT

The first shipment from abroad of manmade radioactive isotopes was carried out in 1954 in Hungary. This time has been started a new era in the application of isotopes not only on medical field but industrial, agricultural and other fields.

In 1959 the first research reactor was commissioned in the Central Research Institute for Physics in Budapest to produce isotopes for application on various field.

By the beginning of 60's isotope laboratories were established in them a wide scale of industrial and medical radiation device utilizing sealed sources and measuring equipment were manufactured. Recently around 1000 licensed laboratories are in Hungary. The second research reactor was established for teaching and research in Technical University of Budapest in 1971.

In the middle of 70's was decided the establishment of a nuclear power station. The first unit commenced power generation in 1983. The second identical unit was commissioned at Paks in 1984 and it was followed by units 3 and 4. They were connected to the grid in 1986 and 1987. The licensed power level is 460 MW_e (gross) for all four units.

INTRODUCTION

Legal Aspects of Radioactive Waste Management and Disposal

Acts, decrees, orders ,national standards and guidelines are regulating the radioactive waste management and disposal issued at various levels of the regulatory body.

At the highest level legislation was made by the Parliament or by the Presidential Council they were issued decrees of legal forces. Acts and decrees of legal forces are having enacting clauses issued by Governmental Departments as authorities.

For the regulation of waste management and disposal the following acts and decrease of legal force have to be mentioned:

Act on Nuclear Energy	Act No.I. of 1980
Decree Council of Ministers	No.12 of 1980
modified by	No.54 of 1987
Departmental Order of Minister of Health	No. 7 of 1988

The following National Standards are in connection with these issues:

MSZ 14344/ 1 of 1989. Radioactive wastes. Terminology and categorization.

MSZ 14344/ 2 of 1989. Radioactive wastes. Management.

According to the decree of Council of Ministers on enactment of the Act on Nuclear Energy, protection of people against the harmful effects of ionizing radiation is to be regulated and supervised by the Minister of Health. In this respect Ministry of Health and Social Welfare is responsible for , among others, the radiation protection requirements of management and disposal of radioactive waste.

These requirements are covered by the departmental Order of Minister of Health and Social Welfare issued by 1988.

History of the Final Deposition of Radioactive Waste

Since the introducing of multiple use of isotopes in 1954 until 1960 there was not available a central repository for radioactive waste in Hungary. The waste was collected at temporary deposits on-site and in the Central Research Institute for Physics in a temporary waste disposal for the higher activity ones.

Only in 1959 was decided and started the institution of a final depository at Solymár. The disposing of the solid and solidified liquid and biological waste was performed in 4-5 meter deep concrete storage wells in double wall polyethylene bags.

The filed wells was covered with a 40-50 centimeters of concrete plate. The unusable highly active sealed sources were placed into a so cold cylinder storage tank.

By the beginning of early 70's the institution of a new disposal facility, shallow ground type, was decided at Püspökszilágy and since 1978 the central Radioactive Waste Repository (RWR) was put into operation. The facility was instituted for non Nuclear Power Plant (NPP) waste, but this practice has to be stopped in 1989.

It could be interesting to mention that the Solymár Repository was decommissioned and the waste transferred to the RWR.

PRESENT STATUS OF RADIOACTIVE WASTE PROGRAM

Classification of Radiative Waste

According to the national standards any radioactive waste falls into one of the following three categories. Classification criteria according to radioactivity levels are following:

low level	$< 5x10^5$ kBq/ kg
medium level	$5x10^5$ - $5x10^6$ kBq/ kg
high level	$> 5x10^8$ kBq/ kg

For solid wastes from facilities operating nuclear reactors the categorization is based on the surface dose rate measured at a distance of 10 cm. from the drum. It is applicable in the case when the presence of alpha-emitting nuclide can be ruled out and the earlier mentioned classification can not be applied.

low level	< 300 uGy/ h
medium level	300- $1x10^4$ uGy/ h

high level $> 1x10^4$ uGy/ h

More recently it has been recognized that in the execution of disposal of non-high level of wastes it is important to evaluate the quantity and quality of each important radionuclides in the waste, placed into container i.e. drum. A high resolution gamma-spectroscopy is a viable technique for determination of the radioactive inventory. An automatic waste assay system from Canberra-Packard company was installed in 1992. The waste assay system is designed to meet the needs of nuclear power plant in qualitative and quantitative analysis of radioactive waste prior to disposal or long term storage.

Sources of Radioactive Waste

The majority of radioactive waste that is generated in Hungary arises from the operation of Paks Nuclear Power Plant (PNPP). Paks facility houses four VVER-440 pressurized water reactor units so for the total plants it is 1840 MW. So far more than 28 reactor years have accumulated. Recently it provides almost the half of electrical energy for Hungary.

PAKS NUCLEAR POWER PLANT

Spent Fuel Elements

According to the Hungarian policy of spent fuel elements are stored in pools in an interim storage at the Paks reactor site for 5 years and than transport it to the former USSR for reprocessing and HLW disposal. At present the fuel elements are transported to Russia for reprocessing under the earlier inter-governmental agreement with the former USSR. No wastes are currently returned to Hungary. However, there is doubt over the validity of this agreement as it was made with the Soviet Union rather than the CIS or Russia also could be a problem that the fuel is transported over Ukrainian territory to the reprocessing plant. It could be possible that Hungary will be forced to retain spent fuel in the future. Plans are being made for the construction of a dry store for spent fuel at Paks site as an interim storage.

LLW & ILW Treatment and Storage in PNPP

Paks NPP also generates a number of LL and IL Waste streams, both liquid (Table I) and solid in nature . Some of the liquid wastes are semi-solids, being sludgiest and spent ion-exchange resins (Table II) . Compactible solid LLW at power plant is collected in 50-liter welded polyethylene bags and compacted in 200 l-s steel drums. The LLW and ILW solids with sharp edges are directly collected in drums. The compaction is performed into metal drums of 200 l-s using a compactor with 500 kN pressing force, designed and made in Hungary. Volume reduction factor is around five.

Separation of laundry and shower waste streams have already been made at the designer stage and later an oxalic acid elimination technology was developed and introduced. Waters of high salinity are treated by evaporation and the condensate is cleaned with ion -exchange resins. Same procedure is used in case of controlled leakages, drainage for processes, floor drains and decontamination fluids. The annual accumulation of evaporator concentrates and the storage capacity available is shown in Table I. The total gamma activity of the evaporator bottom is about 250 GBq.

Low salinity waters leaving the process cycle are cleaned trough ion-exchange resigns separately according to the activity levels and types of contaminants. Application of thermal resistant long-life ion-exchange resins decreased the amount of spent resins are to be stored before conditioning. Production of spent ion-exchange resins and the available storage capacity are given in Table II.

TABLE I
Accumulation Of Evaporator Concentrates and Storage Capacities

Storage Capacity	4500 m^3
Stored at Present	1512 m^3
Used Capacity	33%
Annual Accumulation	220 m^3
Estimated Life Time 30 Year Accumulation	6000-6500 m^3
Storage Capacity Might be Sufficient for	15 years (1 and 2 U) 10 years (3 and 4 U)

The dry active waste is treated as mentioned before and are stored in an auxiliary building of plant. In total some 500 drums are being stored with an average gamma activity concentration 0.4 GBq/drum.

Liquid radioactive wastes generated in the controlled area are stored in stainless steel tanks. The temporary storage in the plant is expected not to create problems until the end of these century. The liquid radioactive wastes are to be cemented into cement matrix after 5 years storage to permit decay. But the industrial utilization of cementation is not justified before final disposal site and facility will be licensed and constructed.

The expected amount of radioactive wastes during the lifetime of the plant is 30.000 m^3 with a total gamma activity less than 10 TBq.

Non Nulcear Power Plant Radioactive Waste

As it mentioned earlier more than 1000 isotope laboratories are in operation in Hungary generate LLW and ILW. Unsealed and sealed radioactive sources are used in this laboratories. The central RWR was established to dispose the radioactive waste of these facilities such as hospitals various research and industrial laboratories. The waste consist of contaminated tools, equipment and sealed sources also liquids.

TABLE II
Accumulation Of Spent Ion-exchange Resins and Storage Capacity

Storage Capacity	900 m^3
At Present Stored	15 m^3
Used Capacity	1.7 %
Annual Accumulation Rate	0.6 m^3
Estimated Life-time Accumulation	60-70 m^3
Storage Capacity Might be Sufficient	30 years

CENTRAL RADIOACTIVE WASTE REPOSITORY (PÜSPÖKSZILÁGY)

The central RWR was established in 1978 at Püspökszilágy for the deposition of non NPP wastes. A limited amount of the LLW of the plant has been disposed in RWR, but this practice has to be stopped in 1989 due to the strong public opposition. From 1992 the central RWR with the approval of the local governments and public is authorized to receive 1000 m^3 of LLW and ILW of Paks Nuclear Power Plant.

In the last ten years, since 1981 less than 1000 $m^{3\,LLW}$ was accumulated in the facility including the radioactive waste transferred from PNPP before 1989. Table 3. demonstrates details about the amount, type and activity of the disposed radioactive wastes. In 1992 close to 170 m^3 radioactive waste was deposited in the central Radioactive Waste Repository.

The PNPP has taken efforts to establish a new LLW disposal facility south of Paks in the Mecsek mountains at Ofalu, but due to the strong public opposition the construction license was refused by the National Health Inspector General.

FUTURE

The radioactive waste management policy and strategy is under debate in Hungary. No approved policy exists. The political changes in the country did not allow to establish a long-term policy on this field. The original Soviet design on the waste management the on-site storage of liquid wastes and LLW was not found acceptable for the Hungarian Authorities. Therefore in 1983 was decided to apply the cement embedding solidification technology for liquid waste treatment and to find a suitable disposal site in a 100 km radius of Paks. It was mentioned above that this effort was refused by the public. Many problems in connection with the final disposal of all types of radioactive wastes, including high level reprocessing waste or spent fuel and decommissioning waste are still unsolved.

The following basic actions were taken and put in progress:

1. The site selection has to be repeated for a new final disposal facility. Coordinated efforts are taken with close collaboration of the ministries involved in the necessary steps of the establishment a new final disposal facility for LLW/ILW.
2. Due to the unpredictability of the political and economical processes take place in the ex-Soviet Union, Hungary decided to prepare itself for spent fuel storage.

CHARACTERIZATION CRITERIA OF RADIOACTIVE WASTE

According to Radioactivity Levels

low level	$< 5x10^5$ kBq/ kg
medium level	$5x10^5$ - $5x10^6$ kBq/ kg
high level	$> 5x10^8$ kBq/ kg

According to Dose Rates

low level	< 300 uGy/ h
medium level	300- $1x10^4$ uGy/ h
high level	> $1x10^4$ uGy/ h

Act, Decrees and Standards for Regulation of Radioactive Waste Management and Disposal in Hungary

Act on Nuclear Energy	Act No.I. of 1980
Decree Council of Ministers	No.12 of 1980
modified by	No.54 of 1987
Departmental Order of Minister of Health	No. 7 of 1988

National Standards are in connection with these issue:

MSZ 14344/ 1 of 1989. Radioactive wastes. Terminology and categorization.

MSZ 14344/ 2 of 1989. Radioactive wastes. Management.

THE STATUS OF THE RADIOACTIVE WASTE MANAGEMENT PROGRAM IN HUNGARY

1. History
   - 1.1 Use of isotopes
     - 1954 first shipment to Hungary
     - 1959 first research reactor
     - 1971 second research reactor
     - beginning of 60's multi purpose use of isotopes
     - 1983-87 four blocs of PNPP were put into function
   - 1.2 Legal aspects of radioactive waste management and disposal
2. Radioactive waste disposal
   - 2.1 Until 1960 no central disposal
   - 2.2 1959 waste disposal in Solymár
   - 2.3 1978 central RWR put into operation at Püspökszilágy
3. Present status of nuclear waste program
   - 3.1 classification of radioactive waste
   - 3.2 sources of radioactive waste
   - 3.3 spent fuel elements
   - 3.4 LLW/ILW treatment and storage in PNPP
   - 3.5 non nuclear power plant radioactive waste
   - 3.6 central Radioactive repository in Püspökszilágy
4. Future goals in policy and strategy
   - no approved policy exists
   - coordinated efforts for final disposal of LLW/ILW
   - interim storage for used fuel elements