ASPECTS OF THE ESTABLISHMENT OF AN INTERIM STORAGE FACILITY FOR THE SPENT FUEL IN HUNGARY

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ABSTRACT

The Hungarian nuclear power program was started in late seventies and PWRs of the type VVER 440 were imported from USSR. The four units (each of 440 MWE) of Paks Nuclear Power Plant were put into operation in 1982, 1984, 1986 and 1987 respectively. On the base of the original inter governmental agreement between Hungary and USSR included the responsibility has recently been undertaken by Russia. Due to the political and economical situation it has been made to establish a back-up policy concerning spent reactor fuel elements. For this purpose Hungary is now making arrangements for a 50 years interim storage for the spent fuel at Paks NPP. The Modular Vault Dry Storage (MVDS) technology and a contractor for performing the design has been selected utilizing the assistance of IAEA.

INTRODUCTION

More than 40 percent of generated electricity of Hungary produced by Paks Nuclear Power Plant (PNPP). The power plant contains four units of PWRs of type VVER 440 imported from the former USSR. The first of PNPP was started up in December of 1982. The other three units put into operation 1984, 1986 and 1987 respectively. One third of fuel assemblies are replaces in each year resulting 114 or 121 spent fuel assemblies per unit annually depending actual refueling process. Under the frame of an intergovernmental agreement between Hungary and USSR the generated spent fuels are shipped back to USSR and from 1992 to Russia after 5 years cooling period. Yearly shipment of spent fuel assemblies between 1989 - 1993 indicated by Table I.

TABLE I
Number of Spent Fuel Assemblies Transported to Russia After 5 Years Cooling

Year	No. of Fuel Assemblies
1989	116
1990	235
1991	210
1992	240
1993	180

CHANGE IN BACK-END STRATEGY

This back-end strategy of fuel cycle in PNPP has been changed recently because of significant changes of political and economical situation in East-Europe. As a consequence of the new Environmental Law of Russia the possibility of further return of spent fuel assemblies interrupted, there for NPP specific case a decision was made to make preparations for erection of an intermediate spent fuel storage. This decision leaves fuel cycle back-end open until establishment of the long term strategy.

There is no single right way for selection the best storage concept for used fuel management in an actual NPP, a number of possibility are to be taken into account:

- interim storage in a foreign facility
- reprocessing
- extend the capacity of cooling ponds
- final disposal of spent fuels
- establishment of an interim storage facility.

Based on the evaluation of benefits and costs of above listed possibilities also the particular Hungarian situation a decision was made to make steps for establishment of an on-site interim storage facility, in 1992.

EVALUATION CRITERIA AND PROCESS

In the nuclear industries there are many different types of intermediate storage for spent nuclear fuel. Almost all of them have been licensed in one or more countries. The already constructed ones can be considered as industrial references. Data collection procedure was started relating the potential vendors of required facility. It was foreseen that it will not be easy to compare feasibility studies prepared by different vendors therefore PNPP has determined the required format and content of feasibility studies.

The PNPP has received seven feasibility studies from different vendors for the establishment of interim storage facility for spent fuel. One of them suggested wet storage design and the other six were dry storage type.

The proper organization of the evaluation procedure is a significant credit on the way of success. Nevertheless, it has to be emphasized that there are no golden rules, and every country might have its own ways of organization. The procedure strongly depends on the local circumstances and on the local licensing procedure. Generally, involvement of the full range of local authorities, domestic and independent foreign expert companies in the evaluation process can be recommended. Participation of IAEA might be also very effective, as any statement or advise of the Agency is to be considered the licensing procedure.

As a result first selection period three of the offers remained recommended for further analyses, normalized costs of stored spent fuel are shown on Fig. 1. in case of above mentioned three version. Finally the evaluation procedure resulted the selection of Modular Vault Dry Store (MVDS) offered by GEC ALSTHOM from UK.

This selection was made on the following major aspects:

- actual advise given and contra selection made by some Hungarian authorities and other participants

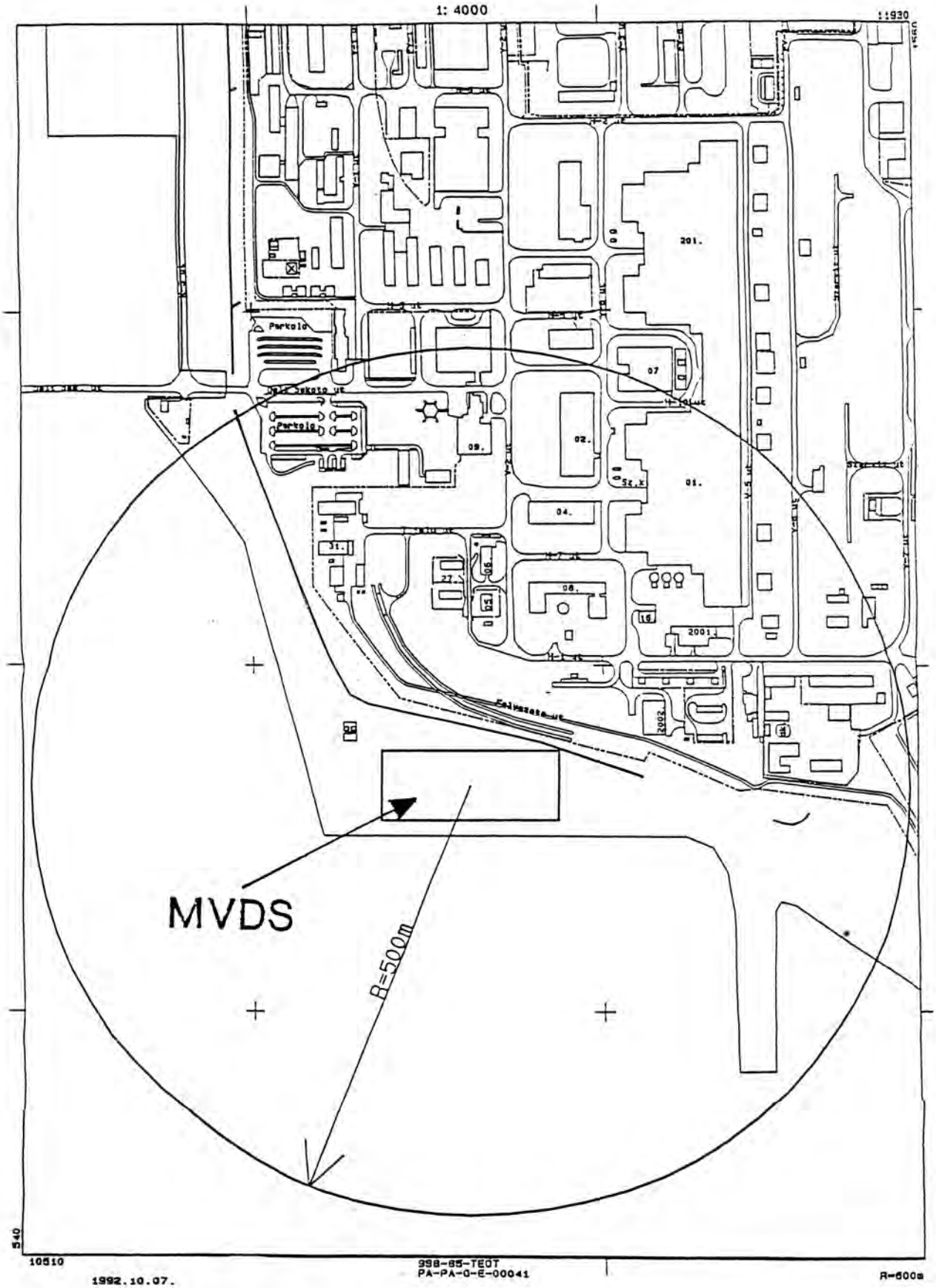

Fig. 1. Normalized costs of stored spent fuel.

- scores given by Paks expert team (based on interdisciplinary analysis of nuclear safety)
- the anticipated general changes in the back-end of fuel cycle strategy.

During the evaluation of the storage options great number of remarks, advise opinions were accumulated. Those of them which were of technical character were incorporated into the above mentioned scoring. On the other hand those, which could not been incorporated directly, were handled independently.

Following evaluation criteria were used for during the decision procedure:

- Nuclear and termotechnical safety
- Radiation protection issues of safety
- Level of quality assurance
- Construction time
- Advantages-disadvantages related to operation
- References of vendor
- Opinion of local authorities
- Maintenance and mechanical engineering
- Costs
- Modularity, lifetime
- Liability and guarantee of vendor
- Civil engineering

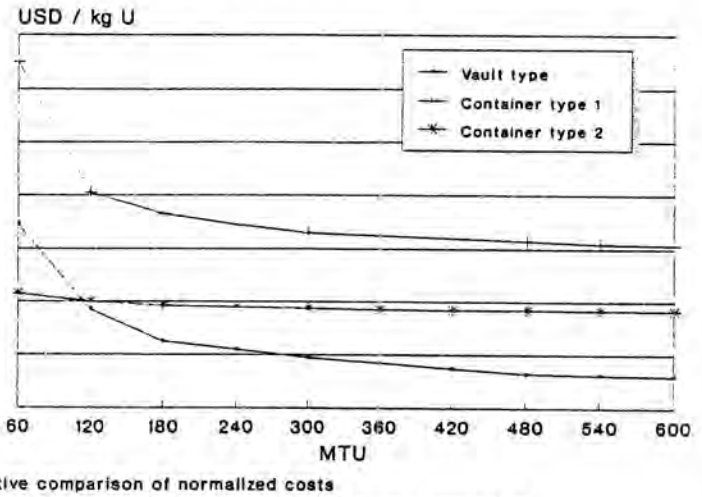

Fig. 2. Normalized cost of stored spent fuel.

SUMMARY

The MVDS system will be used for the interim storage of VVER-440 reactor fuel on the PNPP controlled property on-site (Fig. 2).

The modular dry storage will provide 4950 storage position in three construction phases ensuring storage capacity for ten years production of the NPP. As a result of modularity the designed future extension providing storage capacity for 30 years reactor operation (14850 position) Table II.

The MVDS design ensures that the fuel is protected against the most severe environmental conditions defined for PNPP. The will be maintained in sub critical state at temperatures low enough to preclude fuel damage in order to protect the health and safety of the public.

This protection will be provided by the MVDS system until such time as the fuel assemblies are removed from the facility for off site shipment.

REFERENCES

1. GEC ALSTHOM ENGINEERING SYSTEMS, "VVR-440 Fuel Modular Dry Store at Paks Nuclear Power Plant Preconstruction Safety Report (C)", 1994.

2. GÁBOR BUDAY, "Selection of the Type of the Spent Fuel Storage at NPP Paks", Away from Reactor Storage Concepts and Their Implementation, Technical Committee Meeting, International Atomic Energy Agency, 15-19. March 1993, Vienna, Austria.

3. 10 CFR Ch.I. Part 72: Licensing Requirements for the Independent Storage of Spent Nuclear Fuel and High Level Radioactive Waste, (01. 01. 1990 Edition).

4. Guidebook on Spent Fuel Storage, Technical Report Series, No. 240., International Atomic Energy Agency, Vienna, 1984.

TABLE II
Number of Spent Fuel Assemblies From the Four Units of PAKS NPP
(30 Years Operation, 3 Years Fuel Cycled)

YEAR	I.U	II.U	III.U	IV.U	No./y	TOTAL
1984	114	0	0	0	114	114
1985	121	114	0	0	235	349
1986	114	121	0	0	235	584
1987	121	114	114	0	349	933
1988	114	121	121	114	470	1403
1989	121	114	114	121	470	1873
1990	114	121	121	114	470	2343
1991	121	114	114	121	470	2813
1992	114	121	121	114	470	3283
1993	121	114	114	121	470	3753
2012	114	121	121	114	470	12683
2013	349	114	114	121	698	13381
2014	0	349	121	114	584	13965
2015	0	0	114	121	235	14200
2016	0	0	349	114	463	14663
2017	0	0	0	349	349	15012