

Decommissioning Programmes in OECD/NEA Member Countries

Hungary

Decommissioning of nuclear facilities in Hungary

Current status

At present there are four nuclear facilities in Hungary. The biggest one is the Paks Nuclear Power Plant (Paks NPP) with four VVER-440/213 type reactors, located at Paks, and operated by the Paks Nuclear Power Plant Ltd. The plant's four units have a total capacity of 1840 MW(e) with about 40% of the country's domestic electricity production. On the NPP site has been located also the Interim Spent Fuel Storage Facility (ISFS) of the NPP fuel. The other two nuclear facilities are the Training Reactor of the Budapest Technical and Economical University and the Research Reactor of the KFKI Atomic Energy Central Research Institute of Hungarian Academy of Sciences (KFKI AERI).

In Hungary no nuclear facility is in the stage of decommissioning. Timing of shut down of the Paks NPP could be decisively influenced by feasibility of extending the plant life.

Hungary has put in place a quite classical system for the preparation of future decommissioning of nuclear facilities. The necessary organisation – the Public Agency for Radioactive Waste Management (PURAM) – is being set up in similar way as in many Western European countries.

Local experience in decommissioning is very incomplete, up to now there are no

defined plans for decommissioning of nuclear installations. There can be mentioned only two cases having relation to decommissioning:

- at the time of the reconstruction of the Research Reactor of the KFKI AERI a few technological components were removed and some practice has been obtained on decontamination, cutting, packaging and other activities;
- another case (which is more related to the administrative procedures) is the partial dismantling the ZR-6 critical stand of the KFKI AERI where in the tank of the reactor the basket for fuel elements (core), the control and safety rod mechanisms and the operators' control panel were removed.

From the mentioned four nuclear facility, the decommissioning of the Paks NPP has a definitive role in developing the national strategy of nuclear facility dismantling. As decommissioning of the other three facilities does not seem to cause substantial problem, in the present publication only activities related to Paks NPP decommissioning are introduced.

National Policy

Regulation

The legal background for the decommissioning of the Paks NPP are the Act No. 116/1996 on Atomic Energy and the Government Decree No. 108/1997.

The Nuclear Safety Regulations (NSR) were promulgated as Appendices of this Government Decree. The NSR estimates full releasing of the site for unlimited use as free, non nuclear area.

The Licensee determines when decommissioning should start. License procedure covers 3 phases:

- final shutdown;
- period of preparation for decommissioning (can include a period of safe enclosure);
- period of decommissioning.

For the phase I and II needs Final Shutdown License, for the phase III needs a License for Decommissioning issued by the Hungarian Atomic Energy Authority Nuclear Safety Directorate (HAEA NSD).

Currently there are neither legislative and regulatory requirements which would dictate the decommissioning strategy to be followed.

The existing gaps of the present regulation are the next:

- there are no established legal requirements, circumstances and procedural methods of transition of the responsibilities from the operating organisations (i.e. the Paks Nuclear Power Plant Ltd.) to the appointed organisation (PURAM) fulfilling decommissioning;
- the required contents of the mentioned decommissioning documentation is defined rather generally;
- nowadays the Safety Guides on fulfilment of the compulsory regulatory requirements are missing basically.

Strategy

The first version of the decommissioning study of the Paks NPP was completed at the end of 1993 with the close collaboration of the

DECOM Slovakia Ltd. The revision and updating of the study took place in 1997.

Accomplishing of the study was aiming to help choose the best option for NPP decommissioning.

The study had been elaborated for the following three options:

- immediate dismantling;
- closing under surveillance of the units for 70 years;
- safe enclosure of reactor pressure vessels and their internals in the reactor shafts.

In case of the safe enclosure version three periods were taken into account. 70-year was the target value, but 50 and 100 years has been also estimated.

Closing under surveillance for 70 years option was chosen on the basis of the study and costs of this option were taken into account for payments into the Central Nuclear Financial Fund. (Fund)

Decommissioning Technique and Inspection

Decontamination

By applying the selected decommissioning option, the primary circuit as a whole should not be decontaminated, neither dismantling of the activated components begins before the end of the 70 year decay period.

General principles of pre-dismantling decontamination

Pre-dismantling decontamination includes decontamination of internal and external surfaces of equipment. Determination of equipment and systems to pre-dismantling decontamination will be performed always according to:

- criteria established in advance resulting from radiation safety rules and standards;
- experience acquired from accomplished decontamination and from really attained decontamination factors;
- quantity of arising Radioactive Waste (RAW);
- economic evaluation of decontamination (amount of produced liquid RAW should

be related to benefits and costs resulting from given activities, etc.).

Post-dismantling decontamination of dismantled equipment

It is assumed that the solid radioactive waste generated during the decommissioning of all four units of Paks NPP will be processed in a final processing plant constructed for this purpose at NPP site. Decontamination working area for the needs of post-dismantling decontamination of fragmented parts of dismantled contaminated equipment has been established in this facility. There are two principal reasons for creating this working area:

- to diminish surface contamination up to the level required for free release into the environment;
- to diminish surface contamination up to the level required for the subsequent processing by means of metallurgical melting.

Post-dismantling decontamination of building surfaces

It is supposed that contamination of building surfaces will decrease below the value of 0.4 Bq/cm² after elapsing the time period of the safe enclosure with surveillance. However post-dismantling decontamination of building surfaces is foreseen because during dismantling the active equipment (i.e. with higher internal contamination than 0.4 Bq/cm²) release of radioactive particles will occur and it will re-contaminate the building surfaces.

Dismantling

Dismantling of the active equipment will be performed by common technical means and by suitably modified working procedures used for maintenance. These are: mechanical dismantling (fragmentation), cutting by oxygen-acetylene torch, plasma cutting, hydraulic cutting etc., if the dose rate values at

Radioactive Waste Management

The existing waste management policies and possibilities of a country often play determining role in definition of any decommissioning strategies. Therefore it is useful to present also the situation in this field.

In 1976 the Hungarian authorities, during the revision of the original Russian Technical Design refused the proposed radioactive waste management strategy, and ordered to make a new conception having the essential elements below:

- liquid wastes are not allowed to store in the site of the Paks NPP in liquid form until decommissioning. After conditioning (solidification) and a short time interim storage the waste packages have to be transported to a final disposal facility to be implemented at an early date. Because of this order was the cementation as solidification method selected. A mobile cementing equipment was contracted and purchased.
- solid radioactive wastes are not allowed to get stored in the auxiliary buildings in a bulk form without any volume reduction

the workplace and the surface contamination of the equipment will permit such procedure.

Limited personnel access and the eventual use of special dismantling and manipulating means during dismantling are considered only in the areas with dose rate above 2 mGy/h is.

Demolition

The demolition to elevation of -1.00 m is considered mostly. The considered procedures and technical means for demolition are based on the knowledge of recent techniques and practices used for demolition work.

Inspection

The regulatory approach during decommissioning and normal operation is similar, but the emphasis can be different. It means, that the frequency and nature of inspection can change reflecting to the changing hazard.

and packaging procedure. The solid wastes are put into 200 litre metal drums by a low forced compactor. (Compaction has performed since 1988.)

The failure of the first attempt of licensing (and construction) of the final disposal facility for NPP origin L/ILW in Ófalu became clear in 1990. After this failure, which was a real shock, a new highly detailed radioactive waste management conception was made in 1992 having the following main elements:

- empty storage pits in the auxiliary buildings, interim storage has to be altered for storing the waste packages in a simply retrievable way. This way about 4900 m³ of added theoretical storing capacity could be available, compared to the earlier capacity;
- by international tendering volume reduction technologies had to be selected for more effective volume reduction of both solid and liquid waste. (So, the cementation of liquids can just be done after this volume reduction.)

The selected liquid waste volume reduction technology has got the main features below:

- boric acid removal from evaporator bottom;
- practically all the Cs isotopes can be removed;
- ultrafiltration of small particles in colloid disperse systems.

Expected volume reduction factor of this technology is about 40.

The practice of solid waste treatment does not need conceptual change. Supercompaction campaign could be accomplished if needed, by renting a mobile supercompactor.

Waste packages (200 litre drums containing solids and 400 litre containers containing volume reduced and cemented liquids) are to be stored in the altered interim storage facility within the auxiliary building N^o1. up to the transfer to the final disposal site.

These technological elements were included in the revised conception issued in 1995. The regulator (HAEA NSD) accepted this conception in that year.

Eight years long efforts has been going on, the last two years of which are managed by PURAM to license a new site for the final disposal facility for the L/ILW, having promising geological, hydrological properties as well as political and social perspective to be

Funding/Financing

The Act on Atomic Energy, provided for the Government to take steps aimed at setting up a financial system to implement a coherent and comprehensive solution for the following tasks:

- back-end of the nuclear fuel cycle;
- final disposal of radioactive waste;
- interim storage of the spent fuel;
- decommissioning of nuclear facilities;

According to the Act, financing the tasks mentioned above shall be provided from the Fund, and all costs must be paid by the Licensees (with exception of the budget institutions, in which case by the central state budget).

adopted. The WATRP mission of the International Atomic Energy Agency-overviewing this process and its results suggested, that the investigation should be continued. After the completion of these activities shall the issue be put for decision making towards the site. Because of that it is not possible today to settle the time of putting into operation the facility.

As a result of this time-uncertainty the aforementioned conception had to be changed.

The cementation of the volume reduced, sludge-like liquids is not allowed to start because it would have about three times increased solidified waste volume. Preparations have to be done to build some new interim storage at the site of the NPP, if needed.

High level activity wastes produced during Plant operation (core internals) are stored interim within the main building of the Plant for the whole operational lifetime, constructed as per the original technological design.

Application of any options for the closure of the fuel cycle (vitrified reprocessing residue or encapsulated spent fuel) and the decommissioning of the NPP will necessitate of course also disposal of high-level and long-lived radioactive waste.

As per now the HLW repository has to be licensed and constructed till 2045.

The member of the Government, who supervises the HAEA, is responsible for the operation of the Fund and through the HAEA – as the manager of the Fund – controls the implementation of the management tasks associated with the operation of the Fund.

The Fund is a separate State fund pursuant to Act on Public Finance. 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 Paks NPP, payments made by the licensee to the Fund should be taken into account as expenditure when pricing electricity. (This should be negotiated also with the Hungarian Energy Office.)

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 average base interest rate of the Central Bank.

The payments into the Fund started on January 1st, 1998.

PURAM has to submit a proposal for the long and intermediate term, as well as for the year plans. These will be evaluated by the

special Committee set up by the Hungarian Atomic Energy Commission and chaired by the director general of HAEA.

The plans negotiated by this way, are to be approved by the Minister supervising the HAEA who submits the plan for inclusion into and approval within the yearly budgetary act. Following the approval by the Parliament the tasks are to be implemented.

Competent Bodies

Decommissioning, waste management and disposal activities are mainly regulated by the Act on Atomic Energy and decrees on its implementation, which assigned the responsibilities for the following ministries:

- The Ministry of Health (former Public Welfare);
- The Ministry of Environmental Protection (former Environmental and Regional development);
- The Ministry of Interior;

- The Ministry of Transportation and Water Management;
- The Ministry of Agriculture and Regional Development (former Agriculture);
- The Ministry of Economy (former Industry and Trade);

In the case of decommissioning, the licensing authorities are the HAEA Nuclear Safety Directorate and the State Public Health and Medical Officer Services (on behalf of the Ministry of Health).

Public Information

Besides the legal requirements mentioned above, it is mandatory to keep the public informed on a permanent basis of all actions and measures taken. This responsibility involves not just disseminating information but also setting up dialogue with the population and the local, regional bodies involved in the proposed choice of a disposal site or the site for interim storage of spent fuel.

It is of particular importance to obtain widely based social understanding and support for the efforts being directed towards realising decommissioning or any waste disposal activity.

The biggest challenge for experts and scientific community is to raise the level of social trust in its ability and commitment to understand and handle the potential environmental impact.

In 1992 on the initiative of Paks NPP a Social Controlling and Information Association (abbreviated as TEIT) was established with the participation of 13 villages located within 12 km radius of Paks NPP. The main objective was to gain confidence and acceptance for the construction of the ISFS.

The municipalities – with the aims similar to that of the TEIT – founded their own Associations in the surveyed area for the L/ILW (Social Association of control and Information) and HLW disposals (West-Mecsek Information Association).

In the vicinity of the operational Püspökszilágy Waste Treatment and Disposal Facility (only for the institutional waste), the municipalities formed the Isotope Information Association in mid-'98, with the objectives similar to those of mentioned above.