RADIOACTIVE WASTE MANAGEMENT AT PAKS NPP – CURRENT STATUS AND FUTURE

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ABSTRACT

This presentation describes the practices and planned treatment of low level radioactive waste at Paks NPP. Nuclear activities in Hungary are carried out on the basis of the Nuclear Energy Act which deals with all aspects of the nuclear industry.
The original waste management concept applied at WWER nuclear power plants was as follows:

- return of spent fuel,
- storage of untreated solid wastes and liquid concentrates with the aim to treat and dispose of them in the decommissioning stage.

The new waste management program includes preparation and approval of complex treatment and conditioning technologies to deal with all present and future radioactive waste.
Technological development to reduce the volume of waste and to modernize the temporary storage at the Paks NPP has gone into the implementation phase.

INTRODUCTION

Radioactive wastes generated in Hungary arise mainly from the operation of the Paks NPP. This facility provides almost half of the electrical energy produced in Hungary. The Paks NPP is based on Soviet-designed WWER-440/213 type reactors.

Solid Radioactive Waste (LLW/ILW)

Solid waste produced in the main, auxiliary and sanitary buildings are collected in an organized manner as it is generated.

Sources of solid radioactive wastes:

- Activated, or surface contaminated equipment, piping, tubing, fittings, thermal insulation, etc.
- Constructional materials originated from modifications (concrete, wood contaminated metal, cables, etc.)
- Metal wastes produced from maintenance workshops (cuttings, used tools).
- So-called "soft" wastes produced during the maintenance and operation (individual protecting clothing , ventilation filters , cleaning clothes, traps , etc).

Compactable solid LLW at nuclear power plant is collected in 50-liter polyethylene bags. Metallic LLW or ILW with sharp edges is collected directly in drums.

The annual accumulation of compactable wastes after treatment is about 70-80 per cent of the solid radioactive waste. Compaction is performed in metal 200 l drums using a compactor with 500 kN force, designed and made in Hungary. The volume reduction factor is about 5.

During collection the following actions are carried out: measurement of surface dose rate, integrity checking of the drums, determination of surface contamination by smears taken at random. The drums are closed using quick release covers.

A sorting hood is used to separate non-radioactive components from the radioactive waste. Clean waste can be exempted (after measuring) and disposed of at the local communal dump or other site.

Liquid Radioactive Waste

The main sources of operational liquid radioactive wastes are:

- Boric acid containing organised leakage and drains form technology;
- Unorganised leakage (contains some boric acid also);
- Decontamination wastes from rooms in the controlled area;
- Decontamination wastes from primary equipment and primary components;
- Regenerating solutions and rinsing water from regeneration of primary water treatment resin
- Acidic evaporator cleaning and flushing solutions;
- Radioactive liquid wastes from laboratories;
- Radioactive wastes from laundry and showers.

The original treatment of liquid waste consists of the following technological operations:

- collection of various waste streams (e.g. organised and unorganised leakage containing boric acid, liquids from chemical decontamination, regenerates and spent resin sluice water)
- chemical pre-treatment of decontamination liquid to eliminate the oxalic acid
- metaborate pre-treatment of boric acid to achieve higher boric acid concentration from the waste evaporator,
- evaporation of pre-treated liquid waste up to 400 g/dm^3 total salt, nearly half of which is boric acid,
- interim storage of evaporator concentrates .

Treatment of Liquid Wastes Arising during Operation

Improving the segregation of liquid wastes of different chemical composition by modification of the waste collecting system, (e.g. organizing the unorganized borate containing wastes).

Treatment of segregated boric acid concentrates from 12 g/dm^3 to 40 g/dm^3. Pilot plant experiments have been carried out at PAKS NPP showing that, after evaporation, ultra filtration would be useful.

In situ or separate treatment of chemical decontamination wastes for reuse. A technology for treatment of chemical decontamination wastes is under development.

Separate treatment of wastes originated from regeneration and rising of ion-exchange resin.

Discharge of purified water coming from the treatment system

Wet Solid Wastes

- Spent ion-exchange resin
- Spent cartridge filters
- Tank sludges

Spent ion-exchange resin is slurried from processing vessels to waste storage tanks. The storage tank capacity is sufficient for life of the plant operation. To date only about 100 m^3 of spent resin is in the storage tank.

Spent cartridge filters are packaged in special concrete container and stored in the solid waste interim storage.

Sludges are stored in the tanks, treatment of this type of wastes is under development.

Storage Facilities

The storage facilities were designed for interim storage in the auxiliary buildings at the site.

The transportation of low and intermediate level solid radwaste to the radioactive Waste Treatment and Storage Facility was halted in 1996 due to lack of capacity. However, the final repository to be constructed within the PURAM will not be completed before 2008. Anticipating that solid radwaste generation will be similar to that of the previous years, preparation for long term interim on sitestorage is required. Modification of the storage pits in auxiliary building 1, suitable for accommodating a larger volume of waste in a retrievable manner has begun.

Technological Developments Related to Waste Management

The basic element of this new waste management program includes preparation and approval of a complex strategy which deals with all the present and future tasks such as radioactive waste treatment and conditioning technologies.

Technological development to reduce the volume of waste and to modernize the temporary storage at Paks NPP has gone into the implementation phase.

- By an international tendering process, a Finnish technology was selected for reducing the volume of generated liquid radioactive wastes. The technology consists of three subsystems: boron recovery system, caesium removal system and ultra filtration system.
  Function of the technology is to efficiently reduce the volume of the existing liquid wastes. This means that radio-nuclides are concentrated with high decontamination factor to small volumes of waste, and the inactive part of waste is released (as part of the existing plant practice).
- Connecting pipe bridge between the two auxiliary buildings
  The volume reduction technology shall be placed in No.1 and the cementation process will be located in the other auxiliary building. Because of this situation we had to connect

them by a pipe-bridge. This pipe-bridge extends the practical storing capacity of the tanks apart from connecting the systems.

- Cementing technology by MOWA equipment
  Volume reduced waste is going to be cemented. The MOWA cementation equipment will be placed in the auxiliary building 2. Because the unit was not needed immediately, it was lent to Italy for utilization in phased out NPP. It was transported back to Paks in the middle of 1999. Evaporator bottoms and sludges will be solidified with cement.
- Ultra filtration of liquid wastes arising during operation
  For cleaning the boric acid solution and the coolant of twin-unit 1 and 2, ultra-filtration equipment has been obtained. UF reject will be routed back to the liquid waste collection tanks for reprocessing.

  The caesium removal system consists of selective media cartridges. These cartridges will be removed when exhausted and placed in a concrete container and placed in storage.
- The treatment of dry solid wastes
  Supercompaction of compactable dry wastes.

  Incineration of burnable solid wastes. The regulation of licensing and operation of this technology is not ruled out.

REFERENCES

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