Spent fuel management in Spain

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Abstract. The spent fuel management strategy in Spain is presented. The strategy includes temporary solutions and plans for final disposal. The need for R&D including partitioning and transmutation, as well as the financial constraints are also addressed.

1. INTRODUCTION

On July 31st 1999, the Spanish Government approved the 5th General Radioactive Waste Management Plan (GRWP), which sets the new strategies with regards to the Spent Fuel and other High Level Wastes.

The GRWP has been drawn in accordance with the contents of article 4 of the Royal Decree 1622/1984 of July 4th, authorising the constitution of the Spanish Radioactive Waste Management Company, ENRESA. GRWP includes a revision of all the necessary activities and technical solutions applicable throughout the period of activity of the radioactive wastes and covers an updated economic-financial study of the costs of such activities.

As it is known, there are 9 LWR units in operation with a total output of over 7.6 GW. In addition a Natural Uranium, Graphite moderated and Gas cooled, reactor (NUGG) of French design was in operation from early 70's to 1989.

The GRWP forecast that some 6 750tU from LWR will have to be managed, having considered, for planning purposes, that the expected operation life will be 40 years, being the open cycle the primary back-end management system, even through it does not exclude the possibility of a closed cycle. It also considers the necessity of managing conditioned radioactive wastes that will have to return back to Spain, following the reprocessing of the NUGG fuel in France.

As of December 31st 1998, the tonnage already stored at the different NPP's was 2 249t U.

The degree of occupation of the storage pools varies, at that date, from 32% (Vandellos II) to 69% (Trillo). These relatively low percentages of occupation, with some NPP's commissioned in late sixties and early seventies (José Cabrera and Santa María de Garoña) is due to the fact that in all 9 LWR units reracking of the fuel ponds was undertaken. In such a circumstances, only Trillo NPP will need additional storage capacity during the first decade of 21st Century, while the others will require new storage capacity beyond 2010 to up 2022. Special case are the two oldest units where reracking has allowed not to saturate their ponds before the 40 years period expected life.

Table I resumes the spent fuel ponds situation as of December 31st 1998.

2. TEMPORARY SOLUTIONS

In view of the above, a distinction may be made between two phases in analysing possible management alternatives: an initial phase, which would cover up to the year 2010 during which a specific problem would be the case of Trillo NPP and a second phase, from that year onwards, which would include in addition to the tonnage in excess of ponds capacities, the expected return of reprocessing wastes and also the management of the fuel of the first LWR plants to be decommissioned.

TABLE I

Unit	t U	Degree of occupation (%)	Forecast date of saturation
José Cabrera	55	43	---
Sta. María de Garoña	229	58	---
Almaraz 1	318	42	2020
Almaraz 2	314	41	2022
Ascó 1	297	51	2013
Ascó 2	258	44	2016
Cofrentes	364	50	2014
Vandellós 2	210	32	2021
Trillo	204	69	2003
TOTAL	**2249**		

a) Phase 1

A specific temporary storage facility is to be built at Trillo NPP site, which will house the spent fuel in dual purposed metallic casks, which should be available by 2002. This facility has already been designed and the cask has been licensed by the Spanish Authorities.

b) Phase 2

The strategy for this phase consists of having available a centralised temporary storage facility by the year 2010, in order to provide a solution to the problem of the vitrified wastes to be returned. This installation will also be required to store wastes other than spent fuel and HLW which cannot be stored at Shallow Land Low Level disposal facility of El Cabril, as well as, the spent fuel itself as the storage capacity of the LWR's ponds decreases or their dismantling is addressed.

It is considered essential that decisions be taken as regards the location of this Centralised Temporary Storage facility with sufficient time to guaranty its start up in the year 2010. Bringing forward this date would provide a better capacity to respond to any eventuality that might occur in the near future.

Although this strategy is considered to be basic in might be complemented with the construction of individual temporary storage facilities at certain of the NPP's or with another centralised facility serving various such plants.

An alternative to the above management of spent fuel would be to send it abroad for reprocessing, with the disadvantage that this would be economically very costly and that there would be a need for subsequent management of wastes. Consequently a CTS would still be necessary.

3. FINAL DISPOSAL

The strategy adopted to date for the final management of SF and HLW has been based on ensuring the availability of the scientific and technological know-how and capacity required for final disposal in deep geological formations (DGD).

The work performed has led to the following:

- The identification of a large number of zones in the national geography which, from the geological point of view, might be valid pending "in situ" confirmation.

- Significant progress in the generic and specific designs of the disposal systems in each geological medium studied (granite, salt and clays), as well as, in the development and preliminary applications of tools and methodologies required for the assessment of long term behaviour and safety.

- Partial development, through the R+D plans, of basic technologies for site characterisation and modelling of the most relevant processes taking place in the different confining barriers, for applications in safety assessment.

In view of generalised delay affecting the programmes in other countries, the uncertainties regarding definitive solutions and the availability of temporary solutions, decisions regarding a final solution will be postponed until year 2010.

This will allow studies to be made on Separation and Transmutation with the aim of having two lines of progress, DGP and S+P, in such away that is will be possible to provide the Government with the information required for performance, by the year 2010. All the above will be in keeping close relationships with the international programmes, and more particularly of than of those of the European Union, and the initiatives of the different countries channelled through NEA and IAEA.

This new approach needs to reorientate past activities characterised by the postponement of definitive decisions until next decade. These future courses of action will be orientated on the basis of the following considerations:

- The activities relating to the focusing and solution of specific sites are to be suspended. The work will be limited to maintaining the existing know-how and to ensuring its value.

- The safety assessment capabilities should be maintained in the future through exercises incorporating the experimental data and model of the research groups.

Research and Development

Research plays an important part on the waste management actions. Different R+D plans have included partial development of the technologies required, the geophysical, hydrogeological and hydrogeochemical of the geological barrier site.

The 4th R+D Plan, which starts in 1999 and will last up 2003, had to revise its goals and adequate is achievement in accordance with the new strategies settled above, participating actively in the 5th EU Framework Programme.

In that a sense, regarding S.F. the goal of this Plan is to deep in the following fields:

- Basic Technologies:

  It is intended the follow up through dedicated specific research groups the characterisation of fuel and actinide retention, as well as the radionuclide behaviour in the biosphere.

- Partitioning and Transmutation:

  ENRESA will initiate a R+D programme in close collaboration with CIEMAT (National Research Institution on Nuclear Energy). This research programme should be closely linked to those of other European countries, and will deal specially on Hydro and Pyrometalurgical partitioning as well as studies on Accelerator Driven Systems.

- Geological Disposal:

  Natural and artificial confinement will be followed.

4. ECONOMIC AND FINANCIAL ASPECTS

The financing of the costs of the spent fuel management by the entire electricity industry is included within a percentage fee based on the billing of electricity sales. This levy covers all ENRESA activities related to NPP's.

For the purpose of drawing up the GRWP and performing the corresponding economic calculations, it is necessary to establish a series of hypothesis, any variation to which affect the results obtained.

The main hypothesis are:

- Installed power 7.6 GWe.
- Average operating value at 100% output: 7000 hours/year.
- Main economical data:
  - Inflation rate 2%.
  - Discount rate 2,5%.
  - Average increase in electricity demand: 3%.

The cost estimate of all the activities included in the GRWP will be 1.63 TPts'99 (10 G Euro), 57% of which will be dedicated to Spent Fuel and High Level Waste Management.

Taking into account the schedule for construction, operation and dismantling of the projected facilities that would last up to 2070, and the expected life (for economical purpose) of the NPP's the average quota would be 0,8% of the electricity bill up to year 2028, equivalent to 0,464 Ptas'99/kW nuclear.