Decommissioning Licensing Process of Nuclear Installations in Spain

Cristina CORREA SÁINZ.

Enresa, Emilio Vargas 7, 28043 Madrid, Spain

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1.- Introduction

The Enresa experience related to the decommissioning of nuclear facilities includes the decommissioning of the Vandellós I and José Cabrera NPPs. The Vandellós I gas-graphite reactor was decommissioned in about five years (from 1998 to 2003) to what is known as level 2.

Figure 1: Vandellós 1 site in period of latency (Enresa)

In February 2010, the decommissioning of José Cabrera power plant has been initiated and it is scheduled to be finished by 2018.

The decommissioning of a nuclear power plant is a complex administrative process, the procedure for changing from operation to decommissioning is established in the Spanish law.

This paper summarizes the legal framework defining the strategies, the main activities and the basic roles of the various agents involved in the decommissioning of nuclear facilities in Spain. It also describes briefly the Licensing documents required to obtain the decommissioning authorization and the Enresa point of view, as licensee, on the licensing decommissioning process.

2.- Responsibilities and Organization in Spain

The organization and responsibilities involved in the decommissioning of nuclear facilities in Spain are legally defined by Royal Decree 1836/1999 of 3 December approving the Regulation on Nuclear and Radioactive Facilities (RINR) and its subsequent amendments, and by Royal Decree 102/2014 of 21 February on the responsible and safe management of spent nuclear fuel and radioactive waste.

In accordance with the latter decree, responsibility for the management of activities arising from the decommissioning of nuclear facilities in Spain lies with ENRESA (the National Radioactive Waste Company).

The RINR states that when a nuclear facility ceases operation, the holder of the operating permit is responsible for the pre-dismantling activities, and these are regulated by the competent authority. The new conditions governing the activities to be undertaken at the facility until the authorization for decommissioning is granted are established during the permanent shutdown phase. For the purposes of Spanish legislation, the permanent shutdown phase constitutes an amendment to the operating permit.

In order to be granted the authorization for decommissioning, the holder of the operating permit must already have conditioned the radioactive waste generated during the facility's operation. They must also have unloaded the fuel from the reactor and spent fuel storage pools or, failing this, have a plan for spent fuel management approved by the Ministry of Industry, subject to a report from the CSN (Nuclear Safety Council).

On the basis of the legal provisions above, these obligations are set out in a contract between Enresa and the owners of nuclear power plants, which is approved by the Ministry of Industry. The contract defines each party's responsibilities and determines that it is Enresa's responsibility to draft and submit for approval to the Ministry of Industry the dismantling and decommissioning plan for each nuclear power plant, following shutdown.

Figure 2: José Cabrera site under decommissioning (Enresa)

3. Decommissioning Strategy

Current decommissioning strategy in Spain involves complete (IAEA Level 3) and immediate dismantling of light water reactor plants, starting 3 years after shutdown, with an expected duration of 10 years. In the case of the Vandellós I nuclear power plant, Level 3 is expected to be implemented from 2028, with a duration of 10 years.

4. Planning for Decommissioning

Once the decision has been taken to shut the plant down permanently, planning for the decommissioning begins, comprising the following steps:

- Planning, engineering and licensing of the project;
- Radiological characterization;
- Preparation for decommissioning.

In Spain, these activities are in some cases carried out by Enresa and in others by the license holder in cooperation with Enresa.

4.1 Planning, Engineering and Licensing of the Project

The planning phase for decommissioning begins once the date is set for the facility's permanent shutdown. Enresa carries out the tasks included in this phase in coordination with the license holder for the facility's operational phase, within the framework of the contract between Enresa and the owners of the nuclear power plants.

During this phase the following tasks are carried out:

Basic Strategy Study

The Basic Strategy Study for the facility to be dismantled assesses the physical and radiological inventories and the costs of dismantling, and proposes the preferred decommissioning option. Following this, ENRESA begins work on the Basic Engineering and Licensing Documentation for the Dismantling and Decommissioning Plan for the nuclear power plant, in line with the chosen strategy in the facility's Basic Strategy Study.

Basic Engineering and Licensing Documentation

The preparation of the basic engineering and licensing documentation required by Spanish law for the authorization for decommissioning involves the following activities:

- Basic design of the decommissioning plan;
- Licensing documentation required by nuclear regulations and any other documents necessary for the authorization required by environmental regulations, the European Atomic Energy Community (EURATOM) and local and regional authorities.

Detail Engineering

This includes the engineering tasks and design activities for specifying the various tasks involved in site preparation and subsequent dismantling, and setting out their tendering requirements.

In parallel to this, the licensing process for obtaining the authorization for decommissioning is carried out with the competent authorities. This may include a review of the mandatory documents.

4.2 Radiological Characterization

The radiological characterization of a nuclear facility for the purposes of its dismantling is an activity which can be started before the plant has been permanently shut down and which continues until the unrestricted or partial release of the site. Its outcomes are a key element in the planning of the decommissioning.

Radiological characterization includes not only the facility itself but also the environment which may have been affected by the facility's operation.

4.3 Preparation for Decommissioning

Site preparation tasks are begun after the permanent shutdown of the nuclear power plant. Their main objective is to ensure that the facility is made safe. In this respect the following activities must be undertaken:

- Design modifications to discharge systems which are not required following permanent shutdown;
- Reclassification of systems from a safety point of view, in accordance with the new functions and risks;
- Preparation of the site for the decommissioning phase;
- Adaptation of official documentation and any other documentation which governs the operation of the facility in line with the new operating situation and new risks;
- Undertaking of any tasks required by legislation.

Activities whose implementation are the responsibility of the operator of the facility and which are required by Spanish legislation prior to decommissioning are as follows:

a) conditioning the operational waste;
b) unloading the fuel from the reactor and spent fuel storage pools or having a spent fuel management plan approved by the competent authority.

With regard to point b) the option to be put into practice is established in the Basic Strategy Study, previously drawn up by Enresa. Fuel management is a key element to be determined within the decommissioning strategy chosen.

In Spain, in the case of both the Vandellós I and José Cabrera nuclear power plants, the strategy chosen for spent fuel management was its removal from the reactor and the storage pool. These activities, as well as the conditioning of the operational waste, were carried out during the permanent shutdown phase, as stipulated by Spanish legislation.

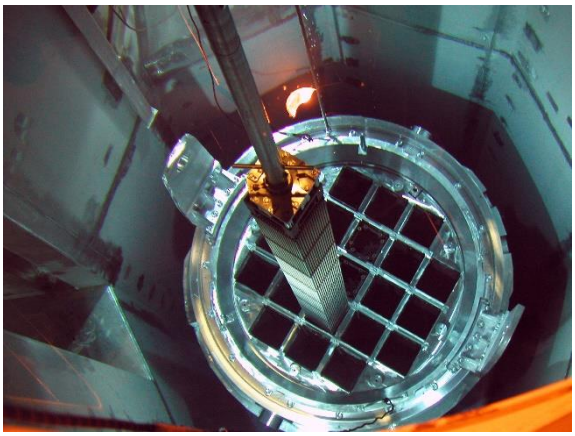

Figure 3: Removing spent fuel

Within this regulatory framework, the permanent shutdown of the José Cabrera nuclear power plant occurred on 30 April 2006 and the authorization for decommissioning was granted on 1 February 2010.

At the Vandellós I nuclear power plant, permanent shutdown occurred in 1989 and the authorization for decommissioning was granted on 28 January 1998.

In the case of the José Cabrera nuclear power plant, the licensee of the facility established action plans some 2-5 years prior to permanent shutdown, in order to adapt all the documentation and systems to the situation of the plant in the shutdown state. A series of design modifications was made to disable some systems in their entirety and in other cases to disable only the specific functions of systems not required in shutdown. Additionally, personnel training began for the permanent shutdown stage.

Site preparation activities for decommissioning which can be undertaken during the permanent shutdown period are as follows:

- Decontamination of the power plant's primary circuit;
- Disabling of all systems, equipment and structures not required for dismantling, including removal of hazardous waste and drainage systems;
- Modifications to existing systems or design of new systems (fire monitoring, electrical, ventilation, instrumentation and monitoring, radiological protection, etc.) to support dismantling activities;
- Construction/renovation of auxiliary facilities (for waste storage, decontamination, immobilization, cutting, etc.) and preparation of work areas to support dismantling activities.

In Spain, these activities may be carried out at the shutdown stage or during the initial phase of decommissioning. They must be included in the official documentation and authorized on a case by case basis.

Figure 4: New Electrical Building (José Cabrera NPP)

During the shutdown stage and in partnership with Enresa, the licensee of the José Cabrera nuclear power plant carried out the decontamination of the primary circuit in order to reduce worker exposure during decommissioning activities. During decommissioning, after the disassembly of the major components at the José Cabrera plant, it was shown that there was a highly significant dose reduction to the workers.

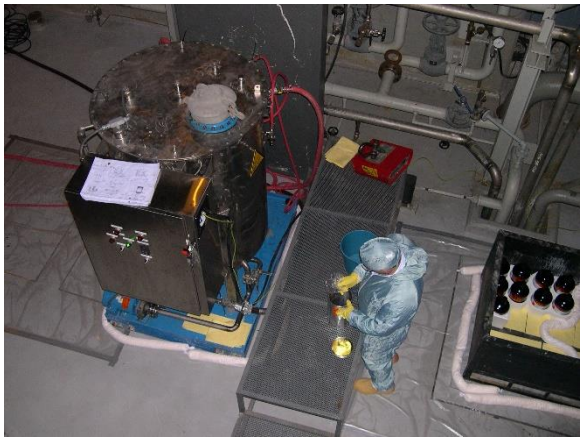

Figure 5: Chemical decontamination of primary system (José Cabrera NPP)

Besides the above, an important aspect to be taken into consideration during the shutdown stage is the licensing for the operating personnel. Under Spanish law, this is specific to the

decommissioning phase and because of this, the personnel assigned to apply for these licenses must be trained during the shutdown stage.

Figure 6: New Fire Protection Pumps (José Cabrera NPP)

Likewise, the personnel who will continue to work during the dismantling must be trained with regard to the new risks and the changes that the plant will undergo.

5. Documentation for the Decommissioning License

The documentation required for the application for authorization for decommissioning a nuclear facility is set out in the regulations governing nuclear facilities. Some of these documents share titles similar to the facility's official documents during its operational phase, but their scope and content differ markedly. These documents include the description, analysis and security guarantees of a process of ongoing changes in the radiological state, with differing risk situations and dynamic activities which occur one after the other, eliminating successive barriers, and which are generally irreversible. There are also documents specific to the decommissioning, such as those related to the management of materials and site restoration. The documentation for decommissioning is adapted to the new risk profile of the plant.

The regulatory documentation and its basic content are as follows:

- Safety Analysis, including the following information:
  - description of the initial state and radiological characterization of the site;
  - general decommissioning project, scope of each phase in the proposed decommissioning, significant tasks and activities that may involve changes in the safety conditions;
  - safety assessment, including the applicable safety and radiological regulations and criteria, as well as the identification of risks under normal operational and accident conditions, and preventive measures to be adopted;
  - environmental radiological impact assessment and radiological monitoring program for implementation during the dismantling.
- Operating specifications, for the equipment and systems which are to be kept operational and which are significant for nuclear safety. Systems which are important for radiological protection are regulated by means of Surveillance Programs that are referenced in this document.

- Operating Regulations, which include descriptions of the organization and responsibilities of personnel involved in the dismantling activities, including the number of required operating licenses.
- Quality assurance manual establishing the scope and content of the quality assurance program designed for the process.
- Radiological protection manual, including the organization, standards and criteria for radiation protection.
- On-site emergency plan detailing the organization and measures planned to address accident situations during decommissioning.
- Physical protection plan, which is confidential and includes measures for organization, equipment, systems and physical safety components.
- Radioactive waste management plan, including the management criteria and strategy for all radioactive waste generated during decommissioning.
- Plan for the control of clearable materials, a document specific to the decommissioning process, which contains the guidelines and methodology for verifying compliance with criteria for clearance of the materials generated during decommissioning.
- Site restoration plan, a document specific to authorizations for decommissioning and which should include the projected final scenario, radiological criteria for the release of the site and the methodology for the final radiological verification. It also includes the initial radiological characterization of the site.
- Economic study including the financial forecasts for the decommissioning project.

This documentation is evaluated by the Spanish regulatory authority (Nuclear Safety Council), CSN. A fluid relationship with the regulatory authority is very important to ensure that there is no excessive delay in obtaining authorization for decommissioning. In general, this is a complex process that takes place in parallel with pre-dismantling activities.

In the case of the José Cabrera NPP, one important issue arising from the review of the regulatory documents was the accident analysis. The set of possible accidents during decommissioning activities as well as assumptions and the evaluation methodology to estimate the doses in the limits of the radius exclusion, they had to be agreed one by one.

The following table shows the type of accidents considered in the Safety Analysis:

Handling of radioactive material
Risks related with decommissioning activities
Release of liquid radwaste
Risks related to spent resins
Fires
Explosion
Risks related with the ISFSI

The decommissioning license documentation established a significant reduction of safety systems and then Operating Specifications. As previously mentioned, the systems considered important for the radiation protection were not included in Operating Specifications and specific Surveillance Programs were developed.

This topic and the criteria for reporting events to the regulatory authority were the subject of extensive discussion and were agreed during the licensing process.

Additionally, other documentation required for decommissioning, based on further regulations, includes:

- Environmental impact assessment (non-radiological);
- Documentation required by Article 37 of the EURATOM Treaty;
- Local and regional regulations.

The environmental impact report (EIR) includes the assessment of conventional impacts (non-radiological), monitoring program and preventive measures to implement during decommissioning works. These identified impacts are: noise, dust, vibration, environmental impact on flora and fauna caused by dismantling works.

According to the Spanish regulatory framework, the radiological impacts, its control and monitoring, they are evaluated by the CSN in the process of decommissioning authorization, as part of the regulatory documentation. The information of the radiological aspects can be included in the EIR but for purposes of completeness only.

Environmental authorization is subjected to public consultation. Scoping is made by the Ministry of Environment with consultation to the stakeholders, local, regional and national authorities. The project and the EIR are made available to the public before the approval. The public is allowed to comment on the environmental issues of the project.

Decommissioning authorization is granted by the Spanish Ministry of Industry, once the Nuclear Safety Council has positively assessed the licensing documentation and the environmental authorization is granted.

6. Conclusions and lessons learned.

The licensing process governing the granting of the authorization for decommissioning in Spain involves various agents in addition to the regulatory authorities at national, local and provincial levels. On the one hand, there is the licensee of the nuclear facility, responsible for its operational phase and shutdown, and on the other, Enresa, the agency responsible for carrying out the decommissioning. The relationship between these two agents is set out in a framework agreement which delineates the responsibilities of each party.

Enresa is responsible for conducting a basic strategy study for the selection of the decommissioning option.

During the permanent shutdown phase, the facility must be prepared for decommissioning as follows: undertaking a series of activities required by legislation, as well as other preparatory activities that are established on a case-by-case basis; preparing the documentation for the authorization for decommissioning, and training the personnel for the new decommissioning phase.

It is very important that good understanding is maintained between the operating license holder and Enresa, to ensure an efficient transition to decommissioning and make good use of the operating personnel's experience in the functioning of the systems. Activities such as the removal of spent fuel, primary circuit decontamination and discharge of systems demands the expertise of the plant's operating personnel.

At the same time, operating personnel who will continue working during the dismantling must be trained on the new documentation and changes to the plant. Decommissioning requires an appropriate mixture of experienced workers with operational memory and new workers with decommissioning experience.

The licenses for operating personnel are mandatory and specific to decommissioning. The number of licenses is established by the regulatory authority in the authorization conditions.

Training for personnel assigned to be awarded operating licenses for the decommissioning phase must begin during the shutdown stage.

The documentation required to obtain the authorization for decommissioning is extensive and it is adapted to the new risk profile of the plant. A fluid relationship with the regulatory authority is very important to ensure that there is no excessive delay in granting the authorization.

References

[1] J.L. Santiago, N. Martín, C. Correa "Marco general y bases de los desmantelamientos de las instalaciones de las instalaciones nucleares", Revista Radioprotección nº 76 Vol. XX, 2013.

[2] M. Ondaro, C. Correa. "Marco normativo y licenciamiento del desmantelamiento. La visión del titular", Revista Radioprotección nº 76 Vol. XX, 2013.

[3] J. Luis Revilla, S. Solís, E. España. "Marco normativo y licenciamiento del desmantelamiento. La visión del regulador", Revista Radioprotección nº 76 Vol. XX, 2013.